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A HANDBOOK OF NEBRASKA GRASSES

WITH ILLUSTRATED KEYS FOR THEIR IDENTIFICATION, TOGETHER
WITH A GENERAL ACCOUNT OF THEIR STRUCTURE AND
ECONOMIC IMPORTANCE.

BY E. MEAD WILCOX, GEORGE K. K. LINK, AND VENUS W. POOL.

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CONTENTS.

	PAGE
Introduction	5
Structure of grasses	6
Directions for use of the keys.....	9
Tribe key to the grasses	11
Notes on economic grasses	77
Bibliography of agrostology	95
Index	112



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A HANDBOOK OF NEBRASKA GRASSES.

BY E. MEAD WILCOX, GEORGE K. K. LINK, AND VENUS W. POOL.*

INTRODUCTION.

The true grasses belong to the one family Poaceae, often called Gramineae, and constitute a very well defined natural group of plants. This family comprises upward of 3,000 species distributed among about 300 genera. From the economic point of view the family is of supreme importance thru the fact that here belong the cereals, which supply a large part of the food of man, and the forage grasses which are so important as feed for our domesticated animals.

The genera and species are for the most part separated by artificial characters—a fact which renders their study and identification extremely difficult even for the expert. The experience of the authors has convinced them that much of this difficulty is to be credited to the "keys" found in our common manuals. Theoretically a key is intended to assist one in properly identifying a plant, but actually many of the keys, upon close inspection, are found to contain so many vague and contradictory statements that they can be depended upon only by the expert who, on account of his working knowledge, makes slight use of the keys.

It occurred to the senior author some years ago that an illustrated key might solve many of these difficulties. An accurate illustration conveys a more definite idea of any particular structure and leaves less room for doubt than any number of words. In fact, the serious and annoying inaccuracies of most keys to the grasses became more and more apparent as the work of preparing the illustrations progressed. The authors are fully convinced that illustrated keys of the type here employed will prove useful in many other groups of plants.

The nomenclature here employed is largely that of the seventh edition of Gray's Manual—the our purpose has not been to insist upon any particular name but to provide means whereby the student can with some certainty attach to any given plant some one name which has been properly authorized.

* Resigned November 1, 1911.

The present key includes most of the species known to occur in Nebraska, tho a few of minor importance and very restricted distribution have been omitted. There are provided also some data on the economic value of certain of the most important species.

The illustrations for the grass keys have been drawn expressly for this publication. They are derived in part from actual authentic specimens and in part redrawn in modified form from various mammals and monographs. The authors have made free use of the mammals, monographs, etc., included in the Bibliography and take this opportunity to commend these publications to the attention of all who wish to learn more of our common grasses. It is hoped that the keys here presented will facilitate the study of the grass flora of Nebraska by farmers and students.

STRUCTURE OF GRASSES.

The grasses are herbs (rarely shrubs or trees) with extensive fibrous root-systems. They may be perennials with rhizomes (fig. 1, A) or sympodia (fig. 1, B), or annuals with sympodia. The extensive system of rhizomes enables these plants to form a "sod" and may render their eradication difficult. The primary root soon disappears, its function being taken over by numerous secondary roots which arise from the nodes.



Fig. 1.



They have cylindrical stems with hollow internodes and generally swollen closed nodes (fig. 2). In some species, such as maize and sorghum, the stems are filled with pith.

The leaves are 2-ranked, narrow, parallel-veined (fig. 3) and consist of two parts, the sheath (fig. 3, C) and Fig. 2. the blade, (fig. 3, A). The sheath with its margins over

lapping, or, rarely grown together, envelopes the internode for more or less of its length (fig. 4). At the junction of the sheath and the blade, on the inside, is an erect membranaceous, hyaline, or hairy appendage, called the ligule (fig. 3, B).

The flowers are grouped in spicate, racemose, or paniculate inflorescences which in turn are composed of partial inflorescences, the spikelets (fig. 6).

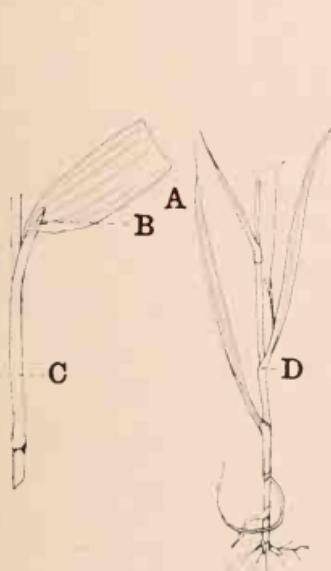


Fig. 3.

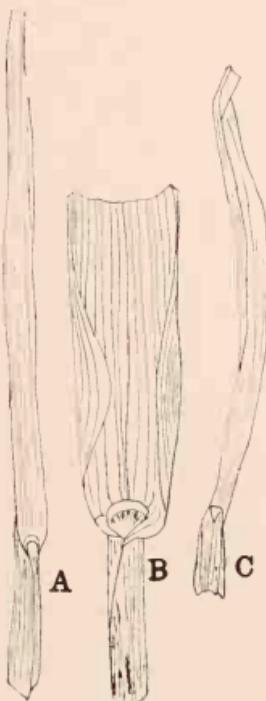


Fig. 4.

Figure 5 shows diagrams of a typical spike, raceme, and panicle. In an inflorescence, the branches are generally subtended by bracts (in grasses such bracts are wanting). In a spike (fig. 5, B) the flowers are sessile on an elongated main axis, the rachis; in a raceme (5, A) the flowers are stalked and borne on the rachis; in a panicle (5, C) the rachis bears racemes laterally.

The flowers, generally perfect (rarely unisexual) (figs. 6 and 7), are arranged in spikelets which consist of a shortened axis, the rachilla (figs. 6, A, and 8, A), and 2 or more 2-ranked bracts (figs. 7, A, and 8).

Usually the lowest bracts are empty and are then called glumes (fig. 8, F). Sometimes the glumes are absent or there may be 3-4 glumes. In the axil of each succeeding bract, the lemma (fig. 8, E) is a flower (fig. 8, B, C), which is subtended and usually enveloped by a bract, the palea (fig. 8, D). The

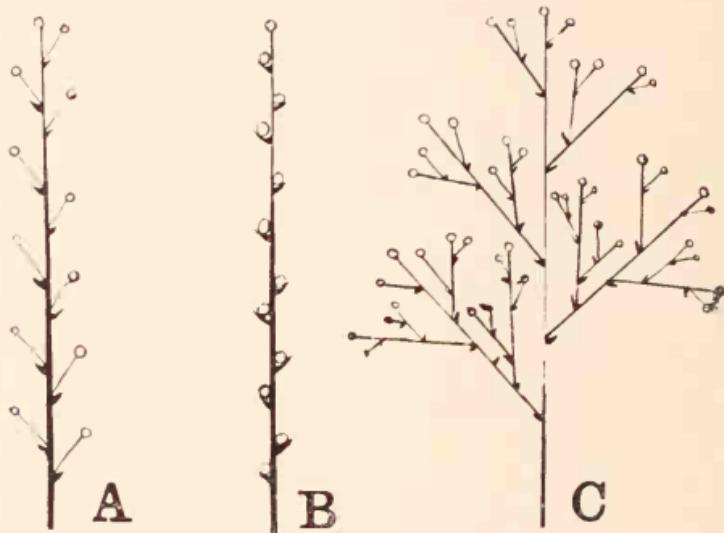


Fig. 5.



Fig. 6.

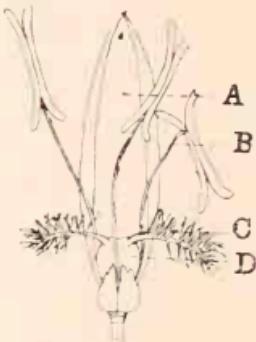


Fig. 7.

lemma often bears a stiff bristle, the awn, which is covered by backwardly turned hairs.

A flower consists of 3 stamens (sometimes 1, 4, or 6) (fig. 7, B), an ovary (fig. 7, D and 8, B), composed of three carpels which bear two feathery papillose stigmas (fig. 7, C), and the lodicules.

The fruit of grasses is called a caryopsis, having the pericarp and seed coat intimately united. The embryo lies in contact with the endosperm (fig. 9, A) by means of its cotyledon. The part of the cotyledon next to the endosperm is the scutellum (fig. 9, C), serving as an absorbent organ in germination. The starch, oil, and protein of the endosperm and embryo render the fruit of grasses of high economic value.

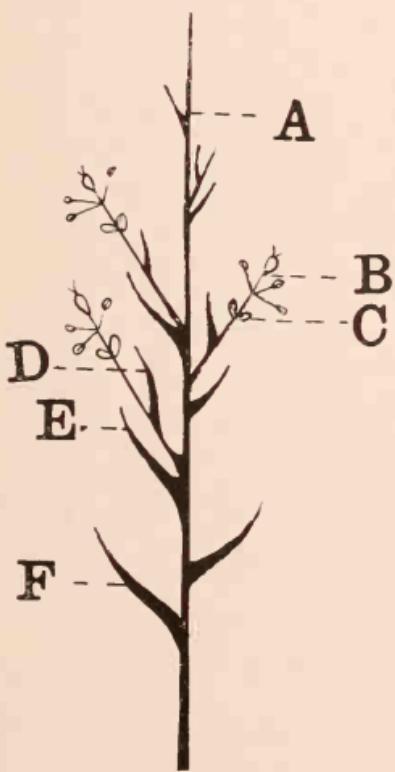


Fig. 8.

DIRECTIONS FOR USE OF THE KEYS.

A good hand lens will be found a necessity in the study of the grasses. The beginner should carefully study the statements under "Structure of Grasses" (p. 6). With a specimen of the grass before him he is then ready to begin the work of identification. As an illustration we may select the awnless brome grass, *Bromus inermis*.

We begin with the "Tribe Key to the Grasses" (p. 11). At the top of the page are found three lines, each describing a cer-

tain group of grasses. We must decide which of the three lines best describes our grass.

Since in our grass the spikelets are in a panicle, like the extreme right-hand drawing of figure 10, we refer next to the lines below marked "3." We must here decide whether the spikelet in our grass has one or two or more flowers. Since this spikelet evidently has more than one flower, as shown in the extreme right-hand drawing of figure 12, we turn next to the lines marked "7" (p. 14).

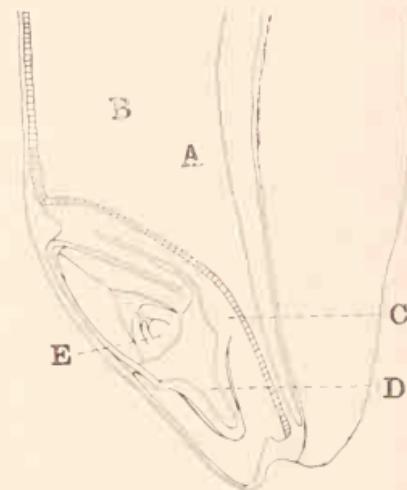


Fig. 9.

Here our decision is required as to the character and location of the awn on the lemma. By consulting the two figures we see plainly that this grass belongs to the tribe FESTUCEAE (p. 44).

Our plant being "erect" we turn to "2" below. The rachilla is found to be "naked," *i. e.*, without any silky hairs, so we refer to "3." With the aid of a lens the "lemma" must be examined to determine the number of its "nerves" or veins. Evidently it has "5-many," as shown in the right-hand drawings of figure 65, and hence we turn to "10" (p. 49).

Our plant is described by the second line under "10" so that we turn to "11" (p. 49). The lemma will be found to be "rounded on the back," which takes us to "14" (p. 50). The lemma being "naked at the base," we go to "15" (p. 51).

Here we find that the second line under "15" describes our grass and we turn to "16" below.

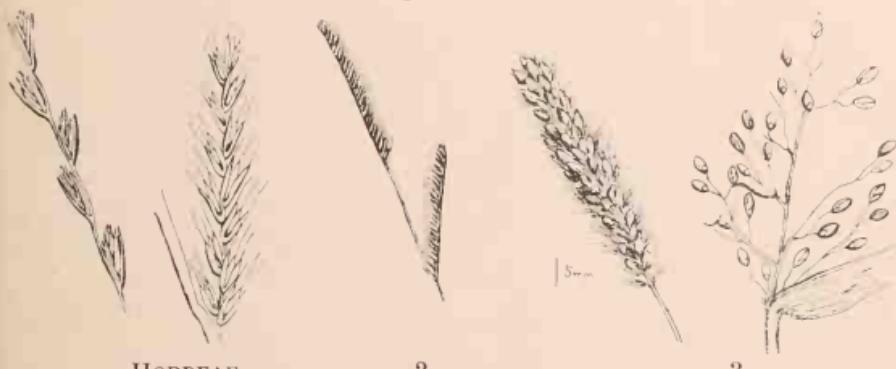
The exact location of the style with reference to the tip of the ovary must next be determined. This brings us to the genus *Bromus*.

To determine the exact species of *Bromus* we must refer to the key to the species of this genus (p. 60) and proceed in the above manner to find the name of the plant before us.

TRIBE KEY TO THE GRASSES.

	FIG.	PAGE
1. Spikelets sessile, alternating on opposite sides of the rachis	HORDEAE	10 66
1. Spikelets sessile or somewhat pedicellate, on one side of the rachis	2	10
1. Spikelets sessile, forming a compact head; or compoundly pedicellate, forming a panicle.....	3	10 12

Figure 10.



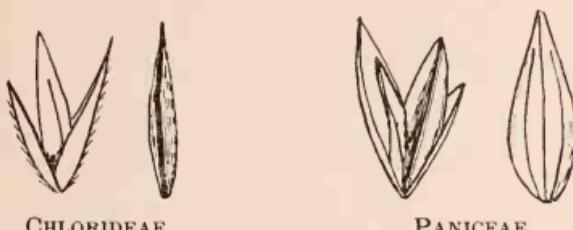
HORDEAE.

2.

3

2. Glume keeled	CHLORIDEAE	11	41
2. Glume not keeled	PANICEAE	11	15

Figure 11.



CHLORIDEAE.

PANICEAE.

	FIG.	PAGE
3. Spikelets with one perfect flower.....	4	12
3. Spikelets with two to many flowers.....	7	12
		14

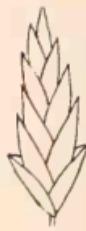
Figure 12.



4.



7.



4. Spikelets, at least some of them, imbedded in the rachis MAYDEAE
 [*Tripsacum dactyloides* is the only species of this tribe included in this key] 13

4. Spikelets free, none imbedded..... 5

24

13

11

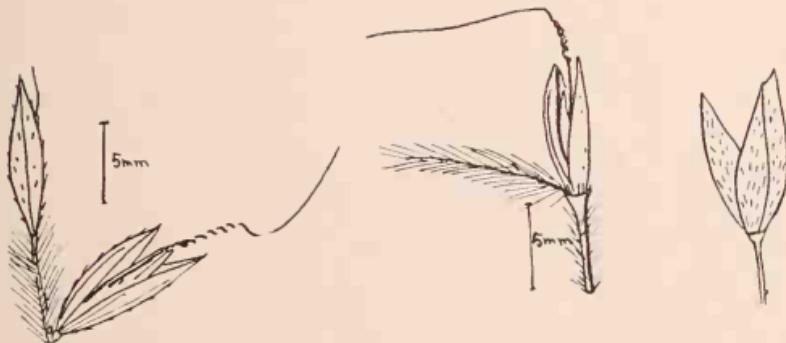
Figure 13.

MAYDEAE (*Tripsacum dactyloides*).

5.

		FIG.	PAGE
5. Spikelets in pairs, one sessile and perfect, the other pedicellate and staminate, empty or reduced to the pedicle	ANDROPOGONEAE	14	14
5. Spikelets single	6	14	

Figure 14.

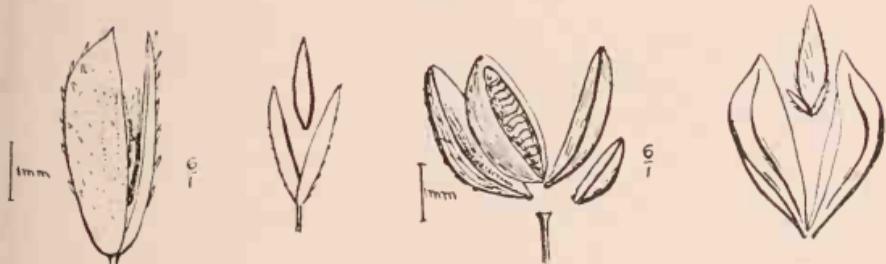


ANDROPOGONEAE.

6.

6. Glumes none	ORYZEAE	15	22
6. Glumes 2	AGROSTIDEAE	15	24
6. Glumes 3	PANICEAE	15	15
6. Glumes 4	PHALARIDEAE	15	23

Figure 15.



ORYZEAE.

AGROSTIDEAE.

PANICEAE.

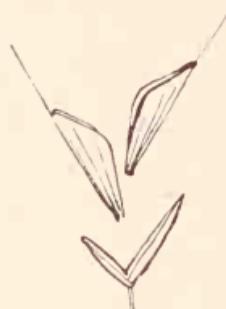
PHALARIDEAE.

7. Awn, if present, straight and arising at or near the apex of the lemma FESTUCEAE
 7. Awn always present, straight or twisted and arising midway between the base and the apex. AVENEAE

FIG. PAGE

16 44
16 39

Figure 16.



FESTUCEAE.



AVENEAE.

ANDROPOGNEAE.

1. Spikelets arranged in a panicle 2
 1. Spikelets arranged in silky racemes 3
 2. Pedicellate spikelet wanting
 *Sorghastrum nutans* 17 92
 2. Pedicellate spikelet present
 *Andropogon halepensis* 17 79

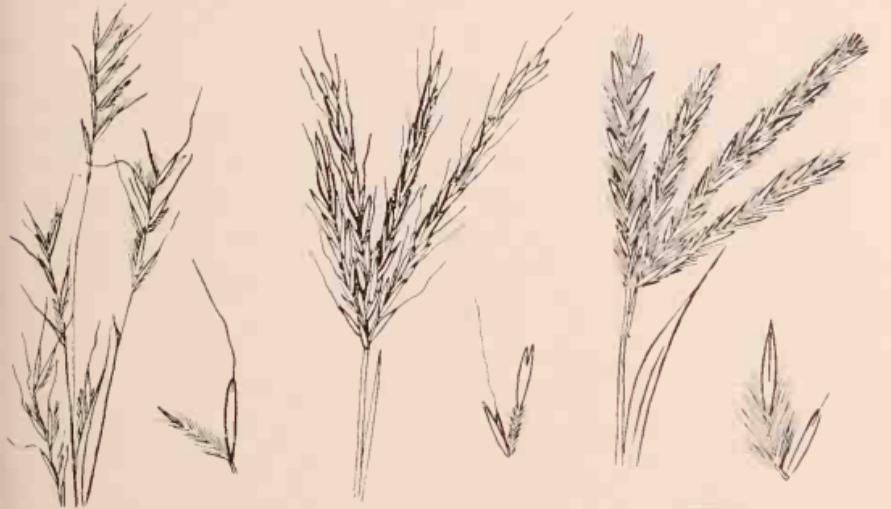
Figure 17.

*Sorghastrum nutans.**Andropogon halepensis.*

3.

		FIG.	PAGE
3. Racemes single.....	<i>Andropogon scoparius</i>	18	79
3. Racemes in pairs	4		
4. Fourth glume with long twisted awn.....	<i>Andropogon furcatus</i>	18	79
4. Fourth glume with short straight awn.....	<i>Andropogon hallii</i>	18	79

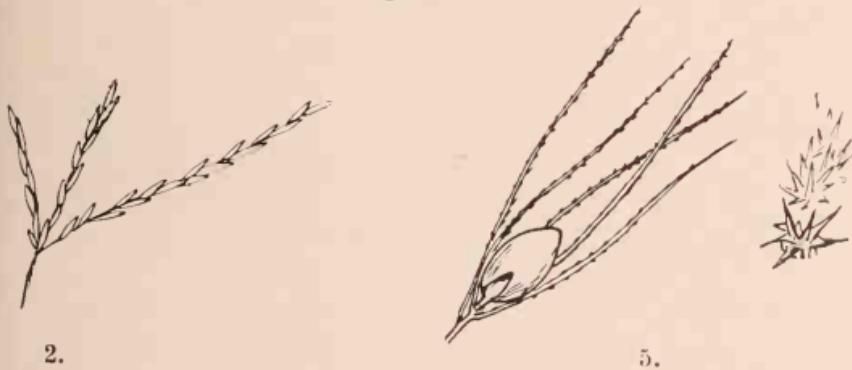
Figure 18.

*Andropogon scoparius.**Andropogon furcatus.**Andropogon hallii.*

PANICEAE.

1. Spikelets not surrounded by bristles nor spines...	2	19	16
1. Spikelets surrounded by prominent bristles or spines	5	19	17

Figure 19.

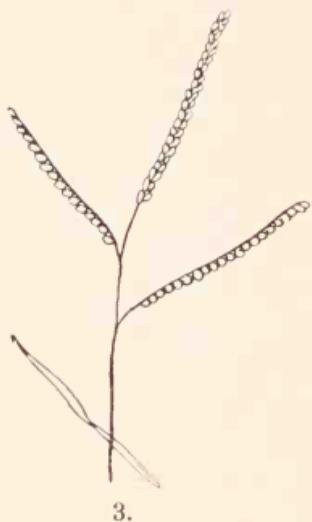


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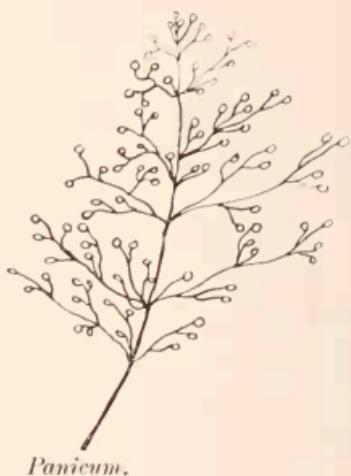
5.

	FIG.	PAGE
2. Spikelets in a one-sided spike or raceme.....3	20	
2. Spikelets in a panicle..... <i>Panicum</i>	20	19

Figure 20.

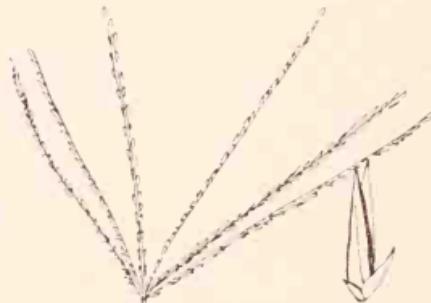


3.

*Panicum.*

3. Racemes in terminal digitate whorls.....		
..... <i>Digitaria sanguinalis</i>	21	84
3. Racemes scattered	4	21
		17

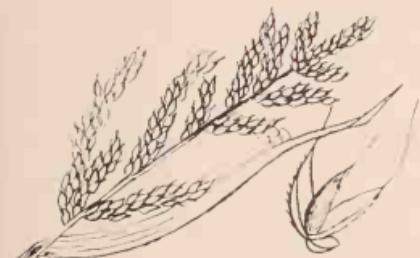
Figure 21.

*Digitaria sanguinalis.*

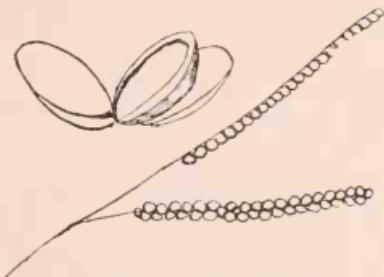
4.

		FIG.	PAGE
4. Glumes awned.....	<i>Echinochloa crus-galli</i>	22	85
4. Glumes not awned.....	<i>Paspalum stramineum</i>	22	90

Figure 22.



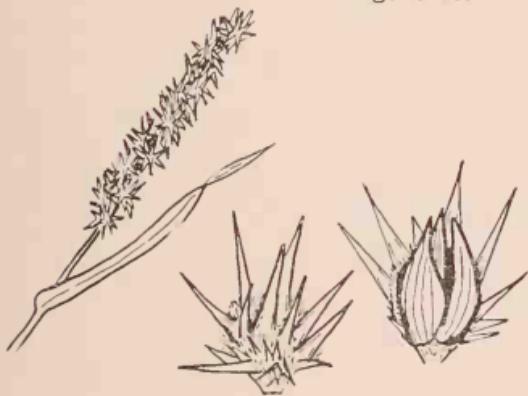
Echinochloa crus-galli.



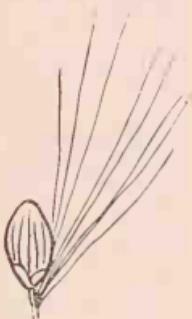
Paspalum stramineum.

5. Spikelet surrounded by thickened spines.....	<i>Cenchrus tribuloides</i>	23	83
5. Spikelet surrounded by bristles.....	6	23	18

Figure 23.



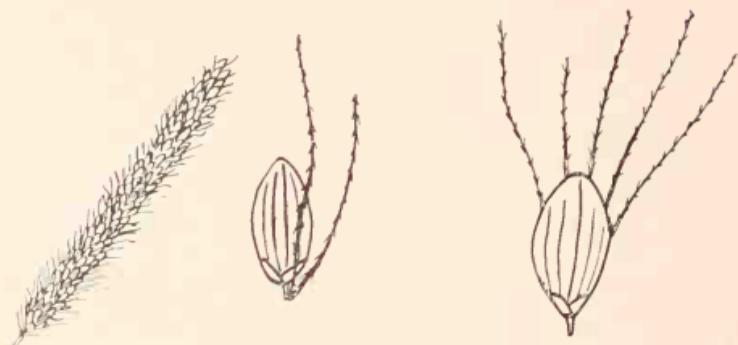
Cenchrus tribuloides.



6.

	FIG. PAGE
6. Bristles downwardly barbed.....	<i>Setaria verticillata</i> 24 92
6. Bristles upwardly barbed.....	7 24

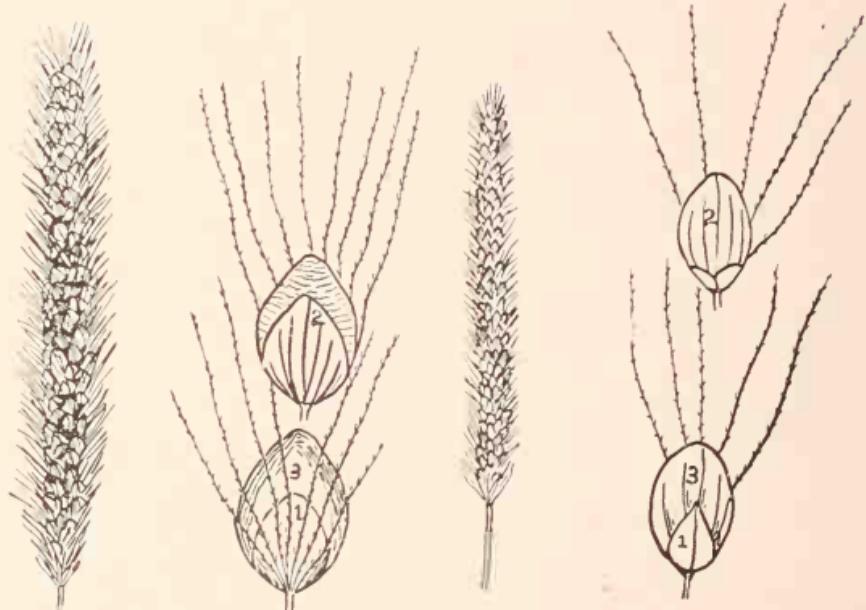
Figure 24.

*Setaria verticillata.*

7.

7. Second glume shorter than the third.....	<i>Setaria glauca</i> 25 92
7. Second glume equaling the third.....	<i>Setaria viridis</i> 25 92

Figure 25.

*Setaria glauca.**Setaria viridis.*

PANICUM.

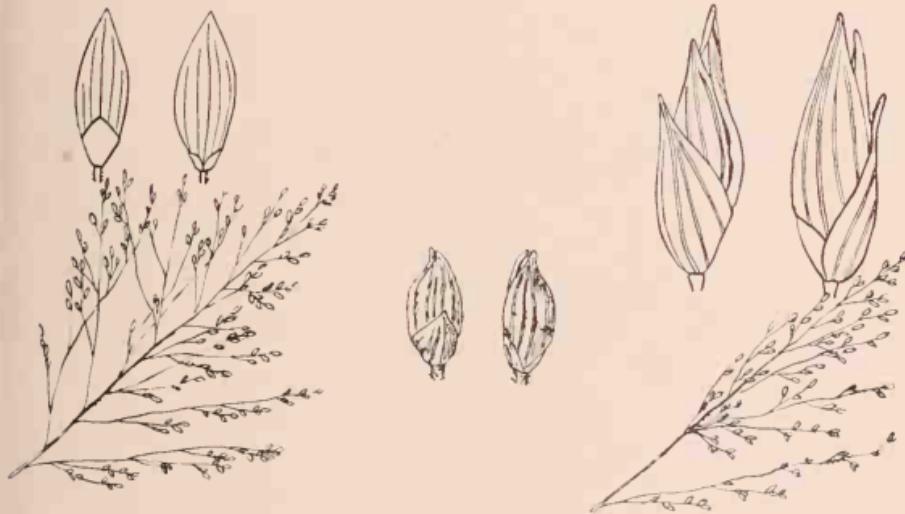
	FIG.	PAGE
1. Spikelets pointed at the tip.....	2	26
1. Spikelets rounded at the tip.....	4	26 20

Figure 26.



2. First glume not over one-fourth the length of the spikelet.....	<i>Panicum dichotomiflorum</i>	27	89
2. First glume about one-half the length of the spikelet	3	27	20
2. First glume two-thirds to three-fourths the length of the spikelet.....	<i>Panicum virgatum</i>	27	90

Figure 27.

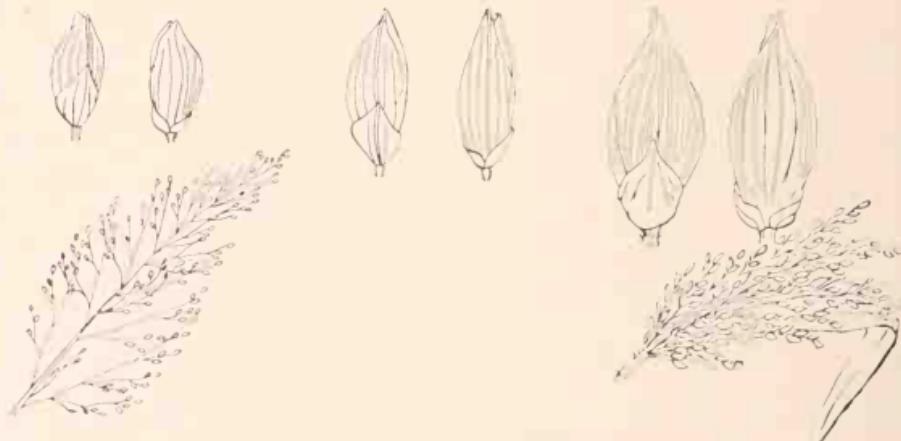
*Panicum dichotomiflorum.*

3.

Panicum virgatum.

	FIG.	PAGE
3. Spikelets 2.5 mm. long or less; blades not crowded toward the base.....	28	89
<i>Panicum capillare</i>		
3. Spikelets 2.5-5.0 mm. long; blades crowded toward the base	28	
4. Spikelets 2.6-3.3 mm. long; panicles erect.....	28	89
<i>Panicum barbipulvinatum</i>		
4. Spikelets 4.5-5.0 mm. long; panicles drooping	28	90
<i>Panicum miliaceum</i>		

Figure 28.

*Panicum capillare.**Panicum barbipulvinatum.**Panicum miliaceum*

5. Spikelets less than 2 mm. in length.....	6	
5. Spikelets more than 2.5 mm. in length.....	7	21
6. Spikelets 1.8-1.9 mm. long; blades with long spreading hairs on the upper surface; first glume triangular, one-third to one-half length of spikelet.....	<i>Panicum praecocius</i>	29
6. Spikelets 1.6-1.8 mm. long; blades with short appressed hairs on the upper surface; first glume, not triangular, about one-third length of spikelet.....	<i>Panicum huachucae</i>	29
		90

Figure 29.

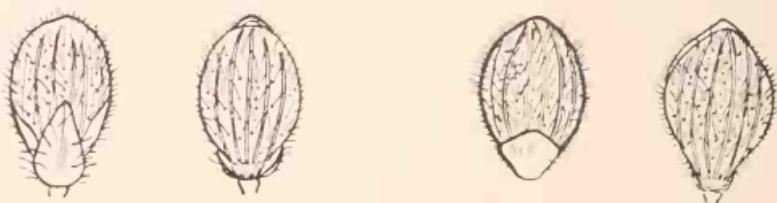
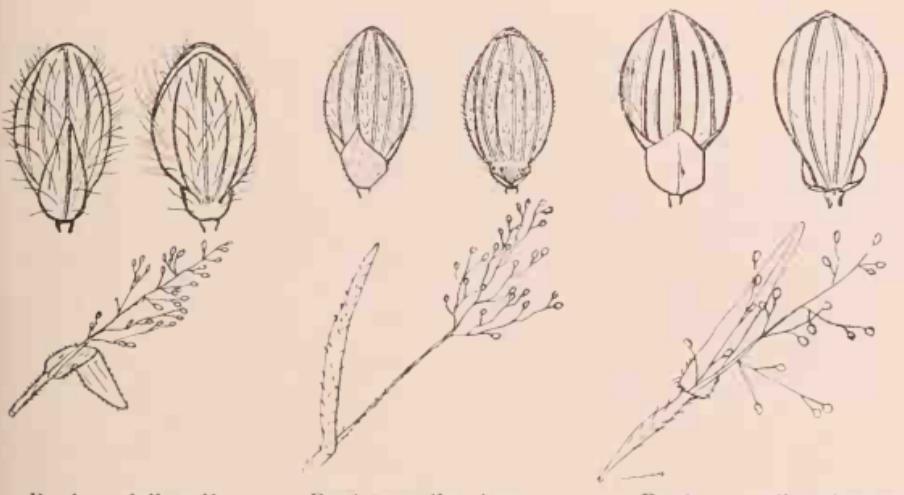
*Panicum praecocius.**Panicum huachucae.*

	FIG. PAGE
7. First glume one-half the length of the spikelet.....	<i>Panicum leibergii</i> 30 89
7. First glume less than one-third the length of the spikelet	8 30
8. Spikelets densely hairy.. <i>Panicum wilcoxianum</i>	30 90
8. Spikelets sparsely hairy to smooth.....	
..... <i>Panicum scribuerianum</i> 30	90

Figure 30.

*Panicum leibergii.**Panicum wilcoxianum.**Panicum scribuerianum.*

ORYZAEAE.

FIG. PAGE

1. Upper spikelets pistillate, some long-awned; lower spikelets staminate, awnless.	<i>Zizania aquatica</i>	31	94
1. Spikelets all alike and awnless.	2		
2. Spikelets 2.5-3.0 mm. long.	<i>Leersia virginica</i>	31	88
2. Spikelets 4-5 mm. long.	<i>Leersia oryzoides</i>	31	88

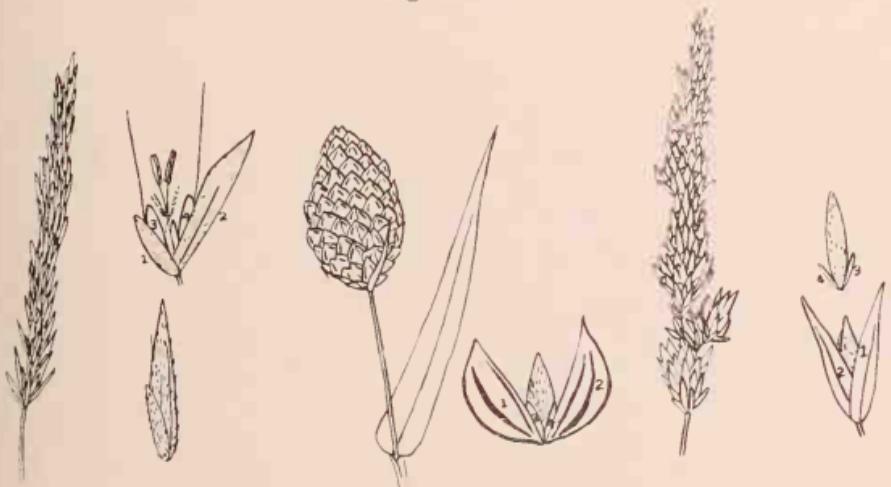
Figure 31.

*Zizania aquatica.**Leersia virginica.**Leersia oryzoides.*

PHALARIDEAE.

	FIG.	PAGE
1. Third and fourth glumes awned upon the back	32	79
<i>Anthoxanthum odoratum</i>		
1. Third and fourth glumes rudimentary, not awned.	2	
2. First and second glumes with wing-like keels.	32	90
<i>Phalaris canariensis</i>		
2. First and second glumes not winged.....	32	90
<i>Phalaris arundinacea</i>		

Figure 32.

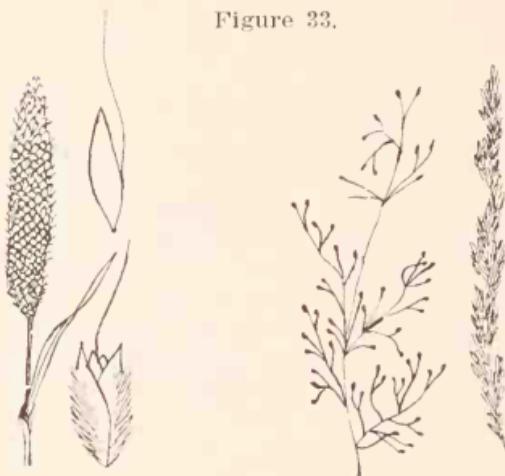
*Anthoxanthum odoratum.**Phalaris canariensis**Phalaris arundinacea.*

AGROSTIDEAE.

FIG. PAGE

1. Spikelets in a close spike.....	2	33
1. Spikelets in an open or contracted panicle.....	4	33

Figure 33.



2.

4.

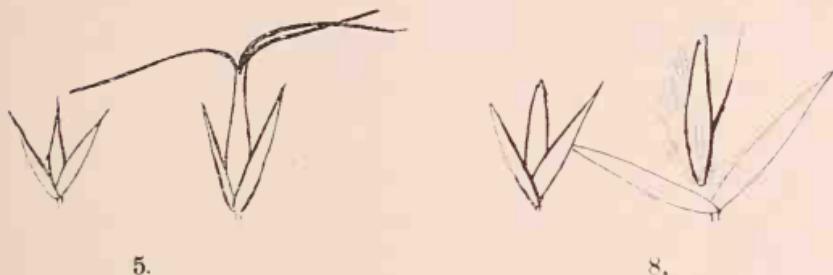
2. Glumes awnless.....	<i>Alopecurus geniculatus</i>	34	79
2. Glumes awned		3	
3. Glumes with a long slender awn.....			
.....	<i>Polypogon monspeliensis</i>	34	91
3. Glumes with a short abrupt awn..	<i>Phleum pratense</i>	34	90

Figure 34.

*Alopecurus geniculatus.**Polypogon monspeliensis.**Phleum pratense.*

	FIG.	PAGE
4. Lemma awn-pointed or with terminal awn..	5	35
4. Lemma awnless or with a dorsal awn.....	8	35
		27

Figure 35.

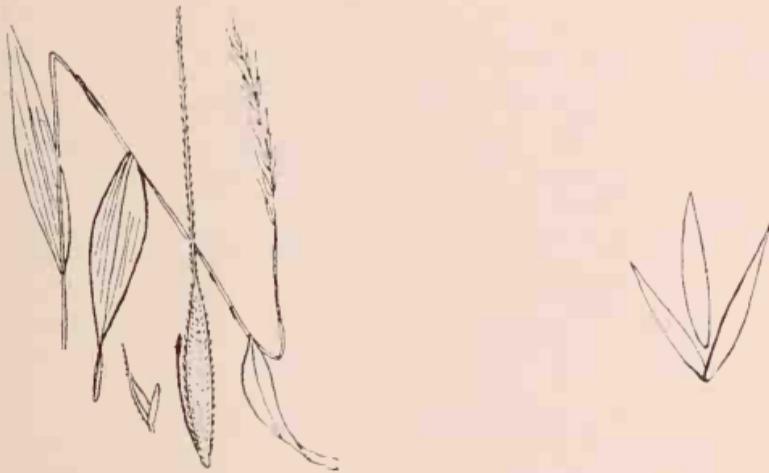


5.

8.

5. Rachilla prolonged behind the palea.....			
.....	<i>Brachyelytrum erectum</i>	36	81
5. Rachilla not prolonged behind the palea.....	6	36	26

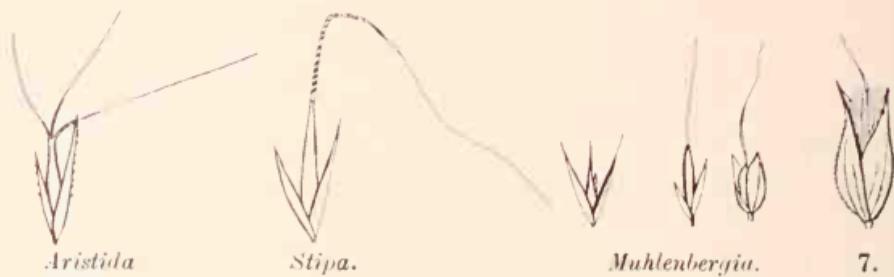
Figure 36.

*Brachyelytrum erectum.*

6.

	FIG.	PAGE
6. Lemma long and narrow with three awns.....	Aristida	37
.....		30
6. Lemma narrow with one long twisted awn.....	Stipa	37
.....		32
6. Lemma short and narrow, awn-pointed or with a slender awn	Muhlenbergia	37
6. Lemma broad, the short awn falling soon after flowering	7	37

Figure 37.



7. Lemma smooth.....	<i>Oryzopsis micrantha</i>	39
7. Lemma with long silky hairs...	<i>Eriocoma cuspidata</i>	39

Figure 38.

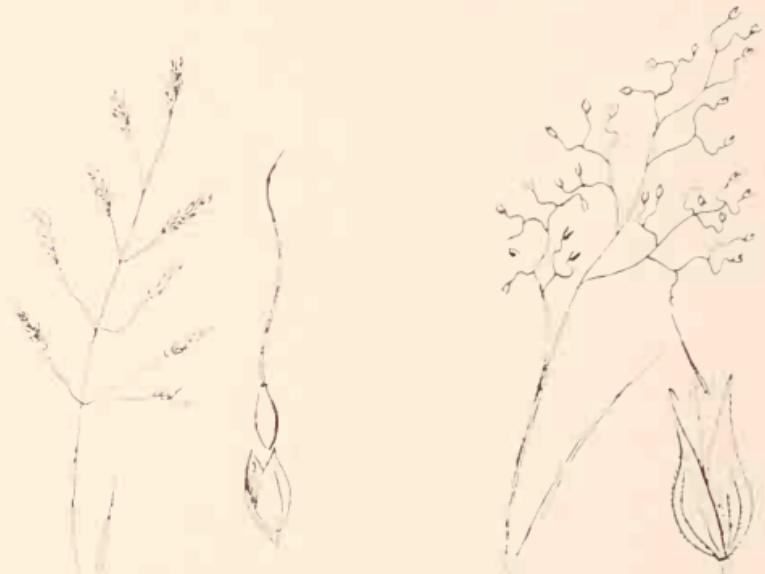
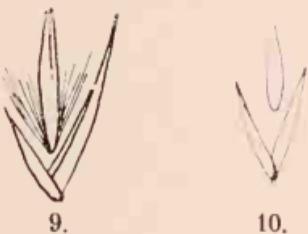
*Oryzopsis micrantha.**Eriocoma cuspidata.*

	FIG.	PAGE
8. Lemma with long basal hairs.....	9	39
8. Lemma without basal hairs.....	10	39
		28

Figure 39.



9.

10.

9. Lemma awned; basal hairs abundant.....	<i>Calamagrostis</i>	40	35
9. Lemma awnless; basal hairs not abundant.....	<i>Calamovilfa longifolia</i>	40	83

Figure 40.

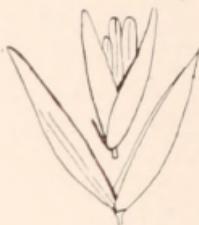
*Calamagrostis.**Calamovilfa longifolia.*

	FIG.	PAGE
10. Flower not plainly pedicellate.....	11	41
10. Flower plainly pedicellate.....	12	41
		29

Figure 41.



11.



12.

11. Lemma shorter than or equal to the glumes.....	42	36
..... <i>Agrostis</i>		
11. Lemma longer than one or both of the glumes....	42	37
..... <i>Sporobolus</i>		

Figure 42.

*Agrostis.**Sporobolus.*

FIG. PAGE

12. Panicle contracted at maturity; first glume shorter than the second.....	<i>Cinna arundinacea</i>	43	83
12. Panicle open at maturity; first glume equal to the second.....	<i>Cinna latifolia</i>	43	83

Figure 43.



Cinna arundinacea.



Cinna latifolia.

ARISTIDA.

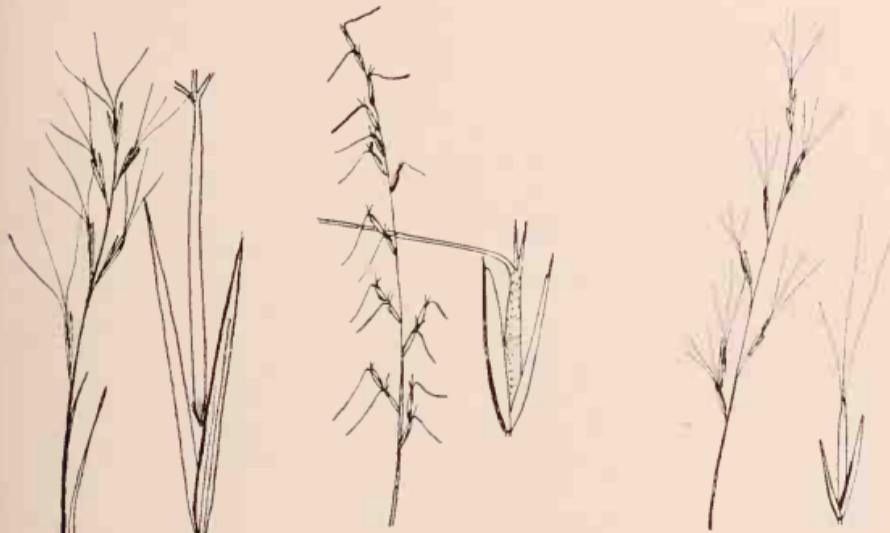
	FIG.	PAGE
1. Awns twisted at the base into a spiral column.....	44	80
..... <i>Aristida tuberculosa</i>		
1. Awns not twisted at the base.....	2	
2. Central awn coiled at the base.....	44	80
..... <i>Aristida basiramea</i>		
2. Central awn not coiled at the base.....	3	
3. First glume one-third the length of the second.....	44	80
..... <i>Aristida longiseta</i>		
3. First glume about equaling the second.....	4	31

Figure 44.

*Aristida tuberculosa.**Aristida basiramea**Aristida longiseta.*

	FIG.	PAGE	
4. First glume 5-7 nerved..... <i>Aristida oligantha</i>	45	80	
4. First glume 1-3 nerved.....	5		
5. Middle awn horizontal; much longer than the lateral awns	<i>Aristida gracilis</i>	45	80
5. Middle awn not horizontal; as long as the lateral awns	<i>Aristida purpurea</i>	45	80

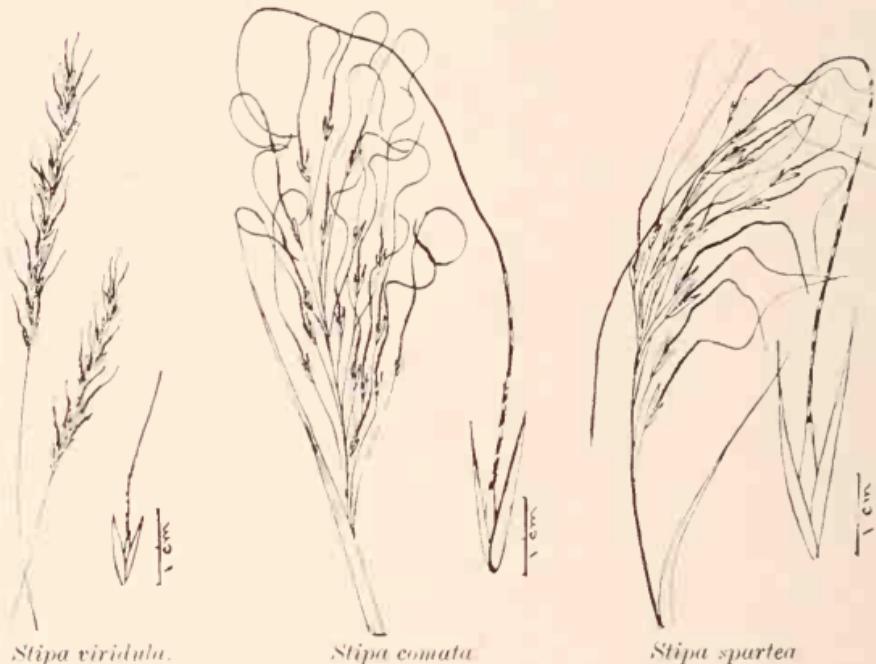
Figure 45.

*Aristida oligantha.**Aristida gracilis.**Aristida purpurea.*

STIPA.

		FIG.	PAGE
1. Glumes 1.5 cm. long or less.....	<i>Stipa viridula</i>	46	94
1. Glumes 2.0 cm. long or more.....	2		
2. Lemma 8-12 mm. long; awn slender and curled			
.....	<i>Stipa comata</i>	46	93
2. Lemma 20-25 mm. long.....	<i>Stipa spartea</i>	46	94

Figure 46.



MUHLENBERGIA.

		FIG.	PAGE
1. Panicle open	<i>Muhlenbergia pungens</i>	47	89
1. Panicle contracted	2	47	

Figure 47.

*Muhlenbergia pungens.*

2.

2. Lemma awn-pointed	3	48	34
2. Lemma long awned	4	48	34

Figure 48.



3.

4.

	FIG.	PAGE
3. Glumes nearly equal in length to the lemma.....		
..... <i>Muhlenbergia mexicana</i>	49	88
3. Glumes longer than the lemma and awned.....		
..... <i>Muhlenbergia racemosa</i>	49	89
4. Glumes equal to the lemma.....		
..... <i>Muhlenbergia sylvatica</i>	49	89
4. Glumes one-half as long as the lemma.....		
..... <i>Muhlenbergia tenuiflora</i>	49	89
4. Glumes less than one-fourth as long as the lemma		
..... <i>Muhlenbergia schreberi</i>	49	89

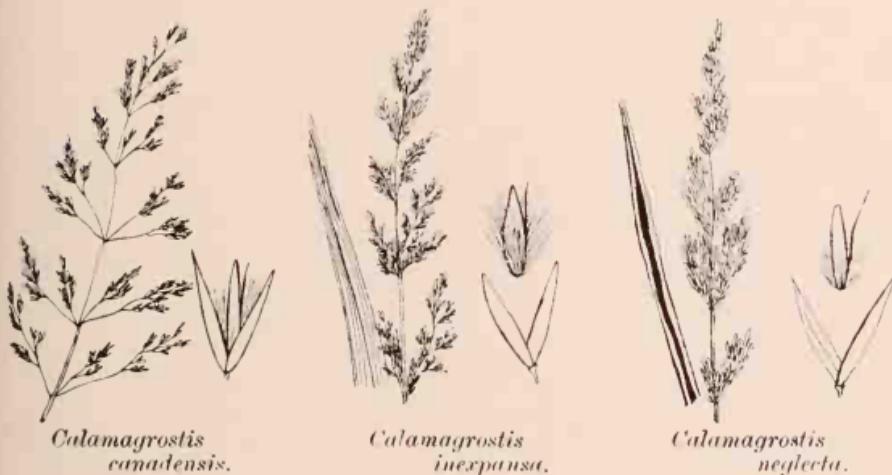
Figure 49.

*Muhlenbergia mexicana.**Muhlenbergia racemosa.**Muhlenbergia sylvatica.**Muhlenbergia tenuiflora.**Muhlenbergia schreberi.*

CALAMAGROSTIS.

	FIG.	PAGE	
1. Panicle open, branches spreading.....	50	83
1. Panicle narrow or contracted.....	2		
2. Leaves flat; basal hairs about equaling the flower	<i>Calamagrostis inexpressa</i>	50	83
2. Leaves rolled together in drying; basal hairs half as long as the flower.....	50	83
.....	<i>Calamagrostis neglecta</i>		

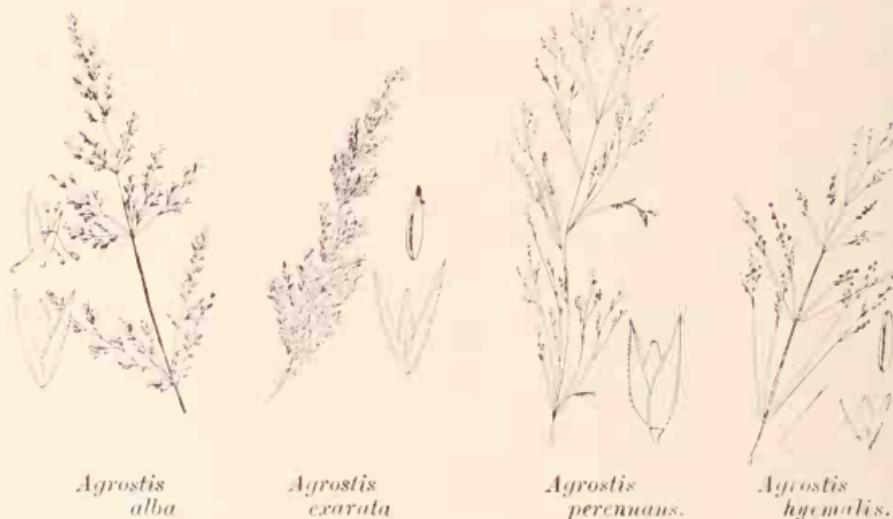
Figure 50.



AGROSTIS.

	FIG.	PAGE
1. Palea conspicuous.....	<i>Agrostis alba</i>	51
1. Palea very small or wanting.....	2	78
2. Panicle narrow.....	<i>Agrostis exarata</i>	51
2. Panicle diffusely spreading.....	3	78
3. Culms weak, usually spreading on the ground.....	<i>Agrostis perennans</i>	51
3. Culms and leaves erect.....	<i>Agrostis hyemalis</i>	51
	78	78

Figure 51.



SPOROBOLUS.

	FIG. PAGE		
1. Panicle contracted	2		
1. Panicle open	5		
2. Spikelets 3.5 mm. or more in length.....	3		
2. Spikelets 3 mm. or less in length.....	4		
3. Palea long awn-pointed..... <i>Sporobolus asper</i>	52	93	
3. Palea not long awn-pointed; panicles conspicuous	<i>Sporobolus vaginiflorus</i>	52	93
4. Sheaths inflated and including panicles.....	<i>Sporobolus neglectus</i>	52	93
4. Sheaths not inflated..... <i>Sporobolus brevifolius</i>	52	93	

Figure 52.



5. First glume about equaling the second.....	6	53	38
5. First glume one-half as long as the second.....	7	53	38

Figure 53.



		FIG.	PAGE
6. Perennial with a long rhizome.....	<i>Sporobolus asperifolius</i>	54	93
6. Annual	<i>Sporobolus confusus</i>	54	93
7. First glume awn-pointed.....	<i>Sporobolus heterolepis</i>	54	93
7. First glume not awn-pointed.....	<i>Sporobolus cryptandrus</i>	54	93

Figure 54.



AVENEAE.

	FIG.	PAGE
1. Awn of second glume hook-like, <i>Holcus lanatus</i>	55	87
1. Awn of second flower not hook-like 2	55	40

Figure 55.



Holcus lanatus.

2

	FIG. PAGE
2. Upper flower of spikelet perfect; the lower staminate <i>Arrhenatherum elatius</i>	56 80
2. Flowers all perfect, or the upper ones staminate	3
3. Spikelets less than 12 mm. long	56 84
3. Spikelets more than 12 mm. long <i>Arena fatua</i>	56 80

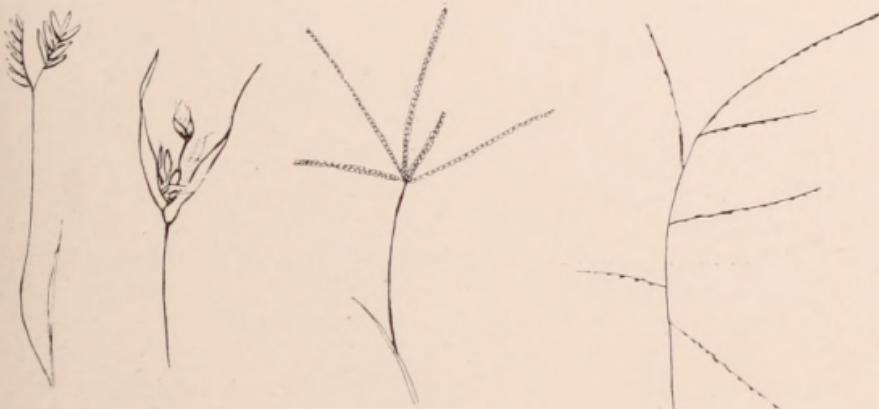
Figure 56.

*Arrhenatherum elatius**Deschampsia flexuosa**Avena fatua*

CHLORIDEAE.

	FIG.	PAGE	
1. Spikelets, with staminate flowers, in conspicuous spikes; pistillate flowers partially included in broad sheaths.....	<i>Buchloe dactyloides</i>	57	82
1. Spikelets with perfect flowers.....	2		
2. Spikes digitate	3	57	42
2. Spikes racemose	4	57	42

Figure 57.

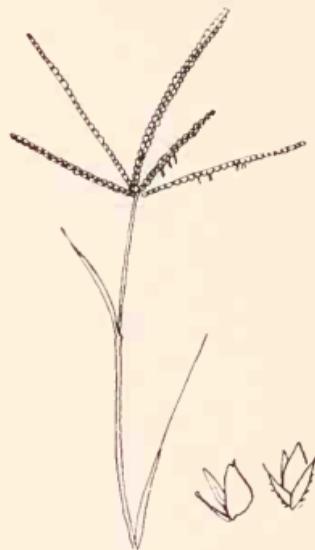
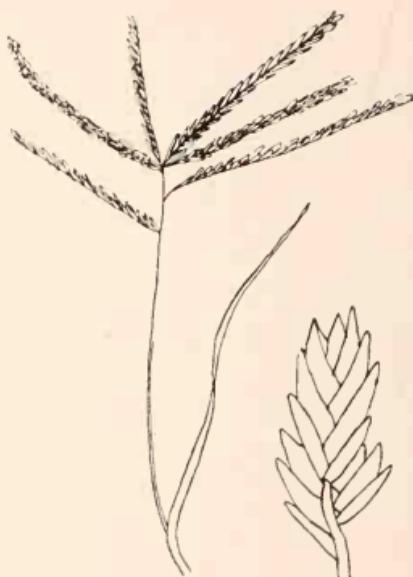
*Buchloe dactyloides.*

3.

4.

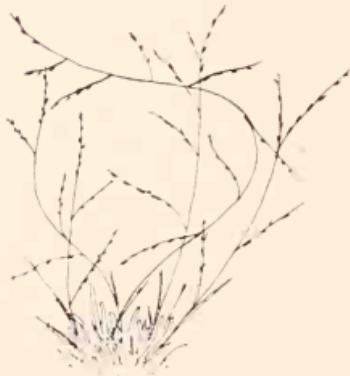
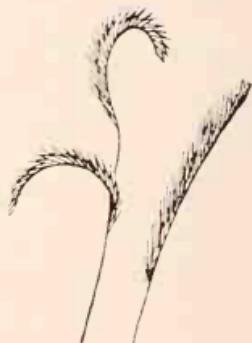
		FIG.	PAGE
3. Spikelet 1-flowered	<i>Cynodon dactylon</i>	58	84
3. Spikelet 3-6-flowered	<i>Eleusine indica</i>	58	85

Figure 58.

*Cynodon dactylon.**Eleusine indica.*

4. Spikelets not crowded	<i>Schedonnardus paniculatus</i>	59	92
4. Spikelets crowded	5	59	43

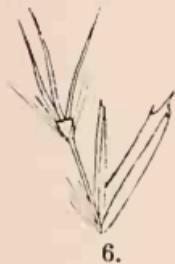
Figure 59.

*Schedonnardus paniculatus.*

5.

	FIG.	PAGE	
5. Rachilla extending beyond the flower and bearing awns	6	60	43
5. Rachilla not extending beyond the flower.....	8	60	44

Figure 60.



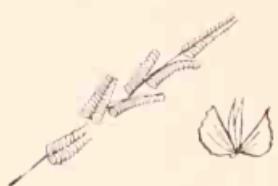
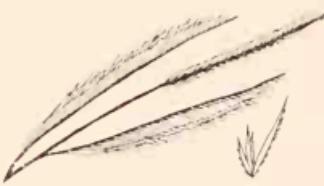
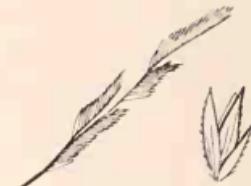
6. Spikes numerous.....	<i>Bouteloua curtipendula</i>	61	80
6. Spikes one to four.....		7	
7. Rachilla with tuft of long hairs at the base.....	<i>Bouteloua oligostachya</i>	61	81
7. Rachilla without tuft of long hairs at the base.....	<i>Bouteloua hirsuta</i>	61	81

Figure 61.

*Bouteloua curtipendula.**Bouteloua oligostachya**Bouteloua hirsuta.*

	FIG. PAGE
8. Rachilla not extending beyond the upper spikelet <i>Beckmannia erucaeformis</i>	62 80
8. Rachilla extending beyond the upper spikelet	9
9. Spikes more than 5 cm. long, <i>Spartina michauxiana</i>	62 93
9. Spikes less than 5 cm. long <i>Spartina gracilis</i>	62 92

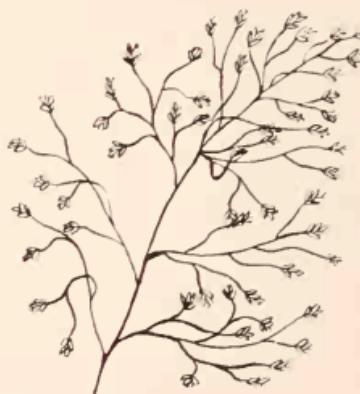
Figure 62.

*Beckmannia erucaeformis.**Spartina michauxiana.**Spartina gracilis.*

FESTUCEAE.

1. Plants prostrate; spikelets in terminal clusters surrounded by stiff leaves <i>Munroa squarrosa</i>	63 83
1. Plants erect; spikelets in loose or contracted panicles 2	63 45

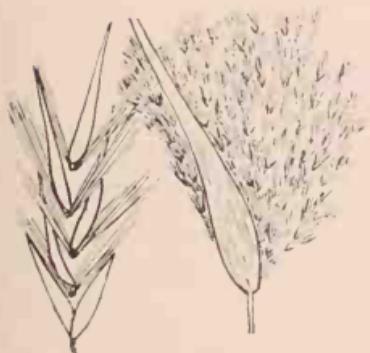
Figure 63.

*Munroa squarrosa*

2.

	FIG.	PAGE	
2. Rachilla clothed with long silky hairs exceeding the florets.....	<i>Phragmites communis</i>	64	90
2. Rachilla naked, or with short hairs.....	3	64	

Figure 64.



Phragmites communis.



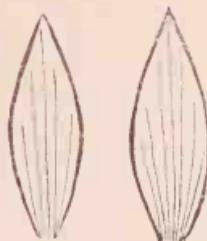
3.

3. Lemma 1-3-nerved or nerveless.....	4	65	46
3. Lemma 5-many-nerved	10	65	49

Figure 65.



4.



10.

	FIG.	PAGE
4. Lemma hard; seed beaked and protruding beyond the glumes and lemma.....		
..... <i>Diarrhena diandra</i>	66	84
4. Lemma soft; seed not beaked nor protruding. 5		

Figure 66.

*Diarrhena diandra.*

5.



5. Lateral nerves of the lemma hairy.....		
..... <i>Triplasis purpurea</i>	67	94
5. Lateral nerves of the lemma smooth..... 6		
	67	47

Figure 67.

*Triplasis purpurea.*

6.

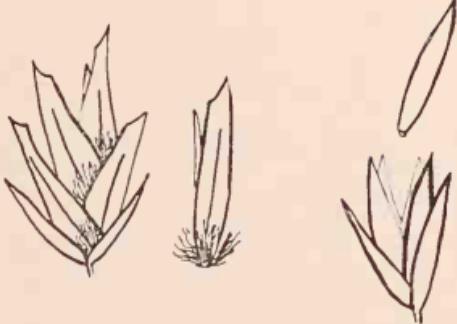


	FIG.	PAGE
6. Lemma hairy at the base, <i>Redfieldia flexuosa</i>	68	91
6. Lemma not hairy at the base. 7	68	

Figure 68.



Redfieldia flexuosa.



7.

7. Second glume very unlike the first, <i>Sphenopholis</i>	69	52
7. Second glume like the first. 8	69	48

Figure 69.



Sphenopholis.



8.

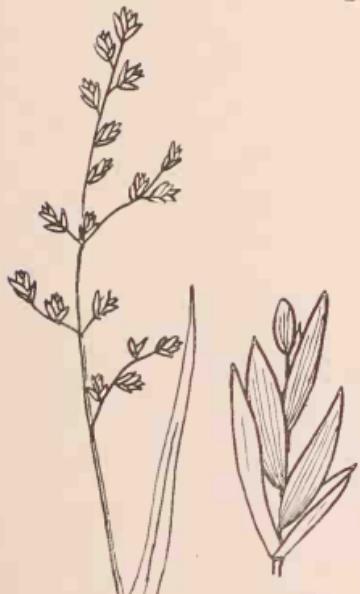
	FIG.	PAGE
8. Panicle dense and spike-like, <i>Koeleria cristata</i>	70	87
8. Panicle open	9	
9. Spikelets 2-flowered; aquatic... <i>Catabrosa aquatica</i>	70	83
9. Spikelets 3-many-flowered; terrestrial... <i>Eragrostis</i>	70	52

Figure 70.

*Koeleria cristata.**Catabrosa aquatica.**Eragrostis.*

	FIG.	PAGE
10. Spikelets with upper flowers sterile and folded about each other	71	88
10. Spikelets with the upper flowers perfect, narrow, or abortive	11	71

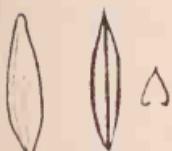
Figure 71.

*Melica nitens.*

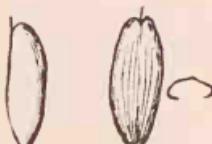
11.

11. Lemma compressed and keeled.....	12	72	50
11. Lemma rounded on the back.....	14	72	50

Figure 72.



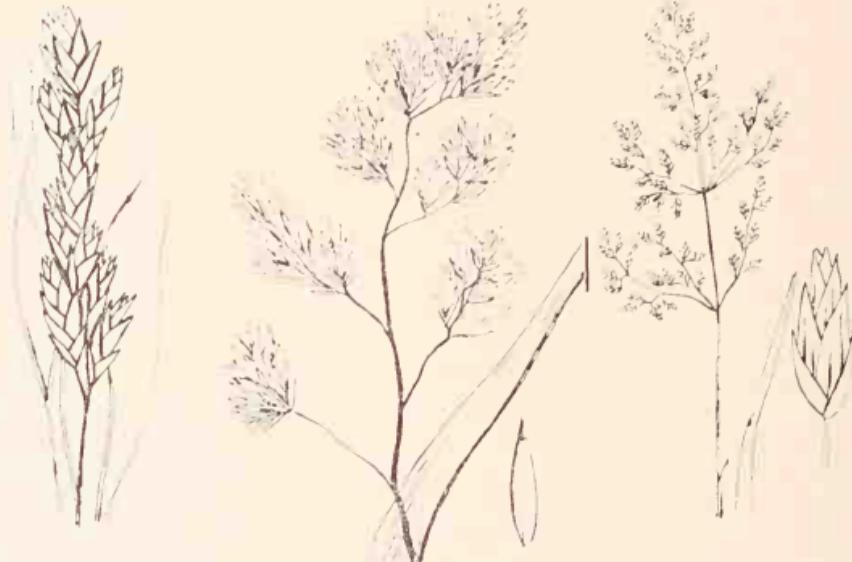
12.



14.

		FIG.	PAGE
12. Panicle contracted.....	<i>Distichlis spicata</i>	73	84
12. Panicle open		13	
13. Lemma awned or awn-pointed.....	<i>Dactylis glomerata</i>	73	84
13. Lemma awnless	<i>Poa</i>	73	91

Figure 73.

*Distichlis spicata.**Dactylis glomerata.**Poa.*

14. Lemma with a basal tuft of hairs; aquatic..			
.....	<i>Scolochloa festucacea</i>	17	92
14. Lemma naked at the base.....	15	74	51

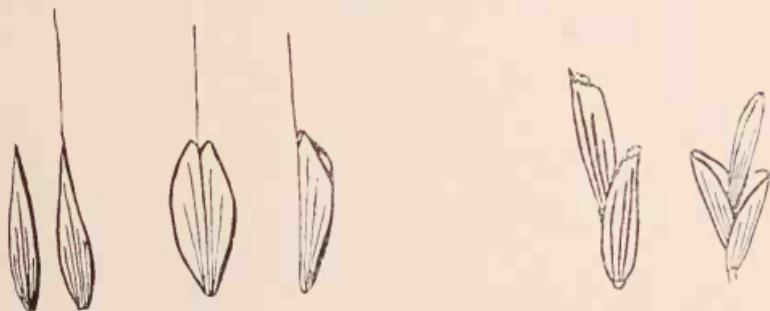
Figure 74.

*Scolochloa festucacea.*

15.

	FIG.	PAGE	
15. Apex of lemma acute, entire, pointed, or awned.	<i>Festuca</i>	75	58
15. Apex of lemma 2-toothed, awn below the apex; or awnless and broadly rounded or obtuse at the tip		16	75
16. Style attached below the apex of the ovary.	<i>Bromus</i>		
16. Style attached to the apex of the ovary.		17	60

Figure 75.

*Festuca.*

16.

17. Lemma obscurely 5-nerved.	<i>Puccinellia airoides</i>	76	91
17. Lemma prominently 6-7-nerved.		18	
18. Second glume 1 mm. long.	<i>Glyceria nervata</i>	76	87
18. Second glume 2.0-3.5 mm. long.	<i>Glyceria grandis</i>	76	87

Figure 76.

*Puccinellia airoides.**Glyceria nervata.**Glyceria grandis.*

SPHENOPHOLIS.

		FIG.	PAGE
1. Panicle dense.....	<i>Sphenopholis obtusata</i>	77	93
1. Panicle longer.....	<i>Sphenopholis pallens</i>	77	93

Figure 77.

*Sphenopholis obtusata.**Sphenopholis pallens.*

ERAGROSTIS.

1. Lemma with obscure lateral nerves.....	2	78	53
1. Lemma with prominent to conspicuous nerves.....	4	78	54

Figure 78.



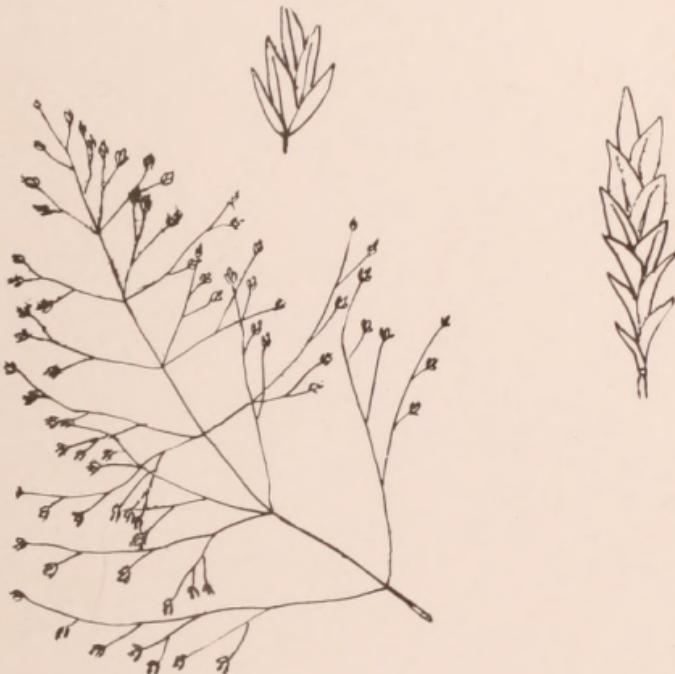
2.



4.

	FIG.	PAGE
2. Spikelets 2-5-flowered.....	Eragrostis capillaris	79 86
2. Spikelets more than 5-flowered.....	3	79 54

Figure 79.

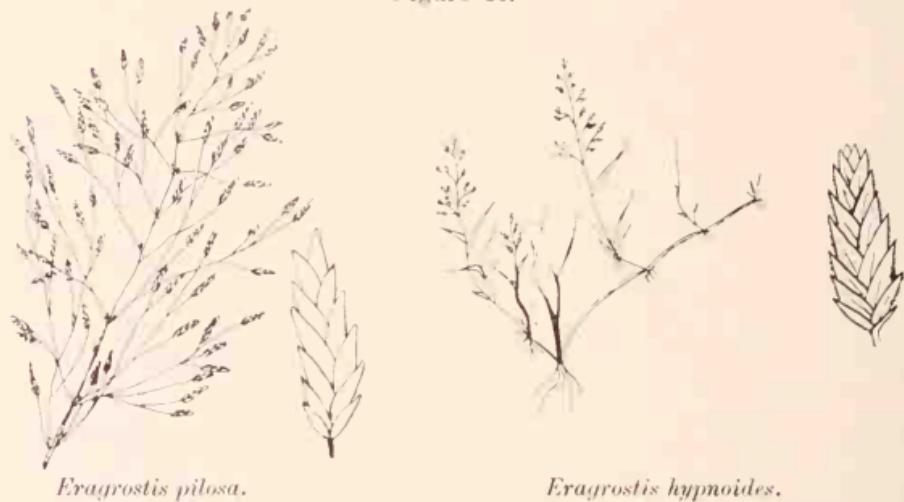


Eragrostis capillaris.

3.

	FIG. PAGE
3. Spikelets 6-20-flowered; panicle 15-30 cm. long,	Eragrostis pilosa 80 86
3. Spikelets 10-40-flowered; panicle 3-6 cm. long,	Eragrostis hypnoides 80 86

Figure 80.

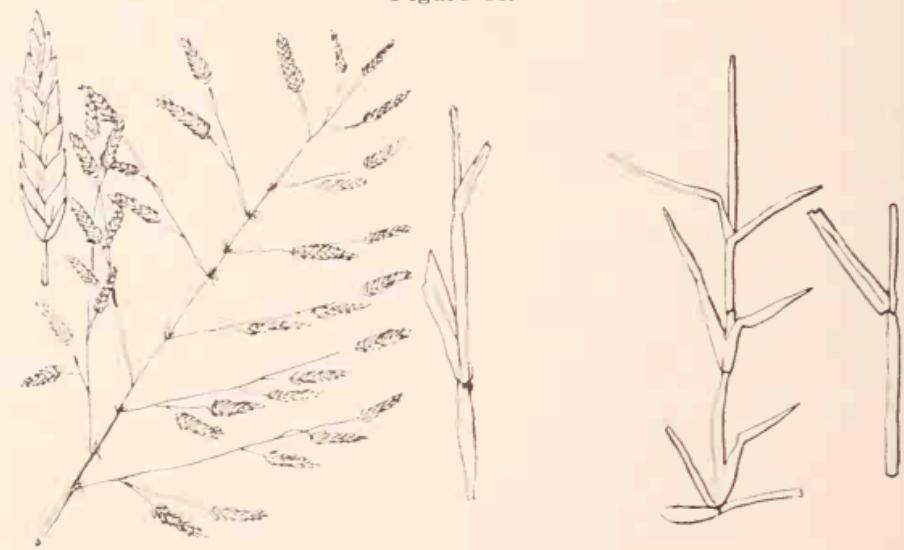


Eragrostis pilosa.

Eragrostis hypnoides.

4. Spikelets less than 3 mm. wide,	5
4. Spikelets 3 mm. or more wide,	7
5. Sheaths overlapping,	Eragrostis pectinacea 81 86
5. Sheaths shorter than the internodes,	6 81 55

Figure 81.



Eragrostis pectinacea.

6.

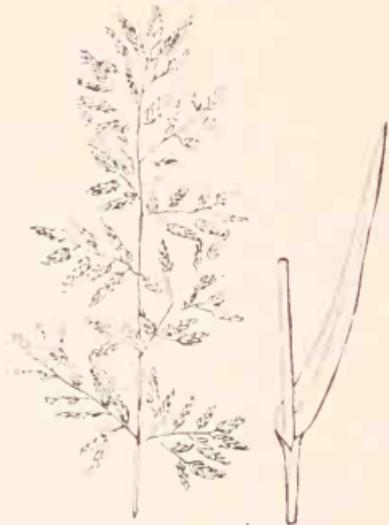
	FIG. PAGE
6. Panicle narrow, 3-6 cm. long; spikelets 10-40-flowered	<i>Eragrostis hypnoides</i> 82
6. Panicle 6-24 cm. long; spikelets 3-15-flowered	<i>Eragrostis pilosa</i> 82
	86

Figure 82.

*Eragrostis hypnoides.**Eragrostis pilosa.*

	FIG. PAGE
7. Sheaths shorter than the internodes; panicle 5-15 cm. long..... <i>Eragrostis megastachya</i>	83 86
7. Sheaths overlapping; panicle 22-67 cm. long..... <i>Eragrostis trichodes</i>	83 86

Figure 83.

*Eragrostis megastachya.**Eragrostis trichodes.*

POA.

		FIG.	PAGE
1. Lemma without basal hairs.....	<i>Poa annua</i>	85	91
1. Lemma with basal hairs.....	2	85	

Figure 85.

*Poa annua.*

2.

2. Culms greatly flattened; flowers usually broader above than below the middle.....			
	<i>Poa compressa</i>	86	91
2. Culms rounded, not greatly flattened.....	3	86	58

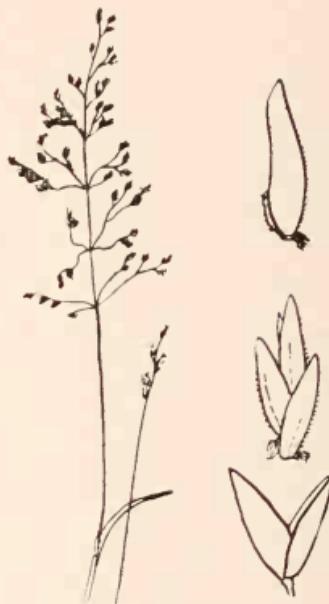
Figure 86.

*Poa compressa.*

3.

	FIG.	PAGE
3. Intermediate nerves distinct..... <i>Poa pratensis</i>	87	91
3. Intermediate nerves not distinct..... <i>Poa nemoralis</i>	87	91

Figure 87.

*Poa pratensis**Poa nemoralis.*

FESTUCA.

1. Leaves 2 mm. wide or less, involute when dry.....2	88	59
1. Leaves 4 mm. wide or more, flat when dry.....4	88	60

Figure 88.



2.



4.

	FIG.	PAGE
2. Spikelets 5-13-flowered	89	87
2. Spikelets 3-6-flowered	3	
3. Panicle close, contracted, expanding while in bloom	89	87
3. Panicle open and spreading	89	86

Figure 89.

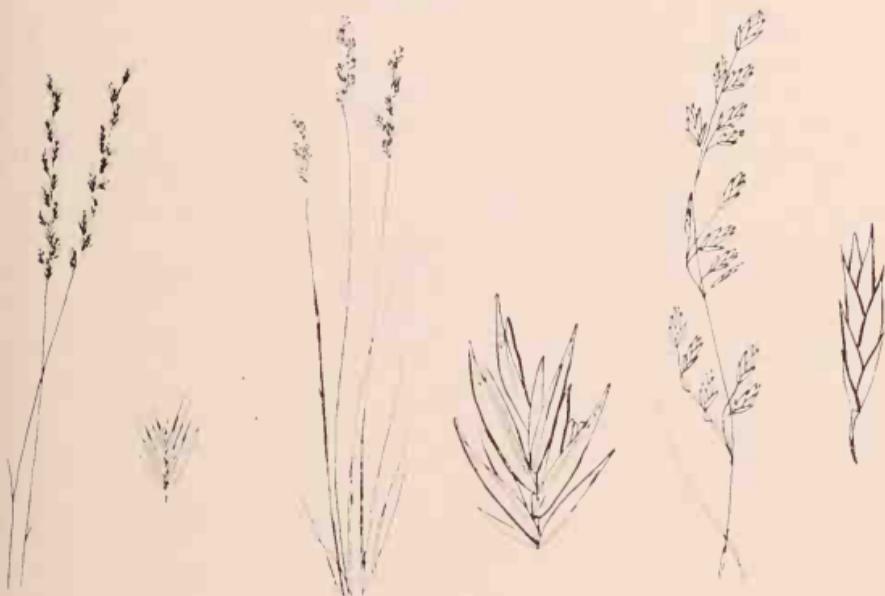
*Festuca octoflora.**Festuca ovina.**Festuca altaica*

		FIG.	PAGE
4. Spikelets 5-10-flowered.....	<i>Festuca elatior</i>	90	86
4. Spikelets 3-5-flowered.....	<i>Festuca obtusa</i>	90	87

Figure 90.

*Festuca elatior.**Festuca obtusa.*

BROMUS.

1. First glume 1-nerved.....	2	91	61
1. First glume 3-nerved	5	91	63

Figure 91.

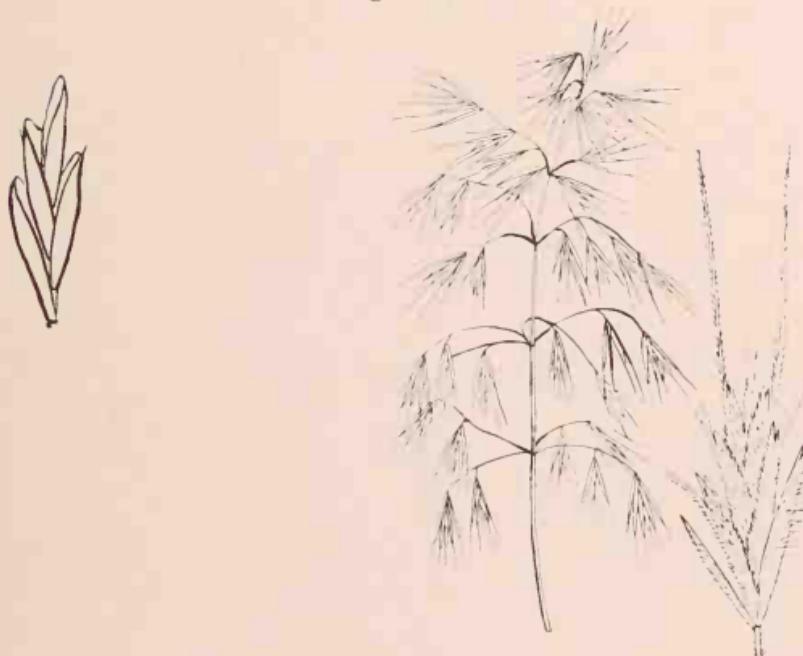


2.

5.

	FIG.	PAGE
2. Awn shorter than the lemma or wanting; tall perennials	3	92 62
2. Awn longer than the lemma; low annuals.....		
..... <i>Bromus tectorum</i>	92	82

Figure 92.



3.

Bromus tectorum.

FIG. PAGE

3. Lemma with awn 1 mm. long, awn-pointed, or awn-less	<i>Bromus inermis</i>	93	81
3. Lemma with awn 6 mm. long or more.....	4		
4. Culms stout; branches of the panicle more or less spreading or drooping	<i>Bromus ciliatus</i>	93	81
4. Culms slender; branches of the panicle erect	<i>Bromus erectus</i>	93	81

Figure 93.

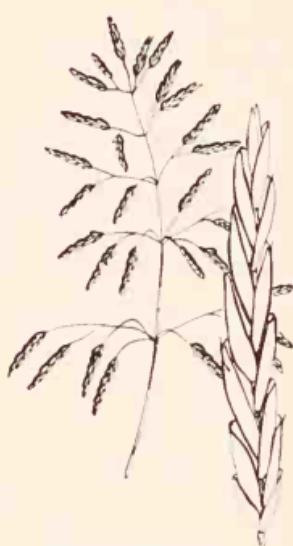
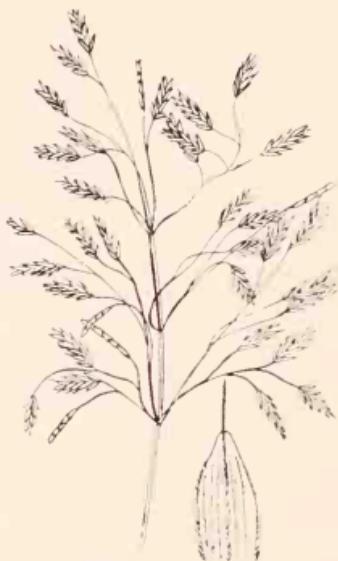
*Bromus inermis.**Bromus ciliatus.**Bromus erectus.*

	FIG.	PAGE
5. Lemma awned	6	94
5. Lemma awnless or with short awn; nearly as long as broad.....	<i>Bromus brizaeformis</i>	94
		81

Figure 94.



6.

Bromus brizaeformis.

6. Lemma hairy	7	95	64
6. Lemma smooth	9	95	65

Figure 95.



	FIG.	PAGE
7. Lemma covered with short appressed hairs.....		
..... <i>Bromus hordeaceus</i>	96	81
7. Lemma covered with long silky hairs.....	8	
8. Second glume 3-nerved..... <i>Bromus porteri</i>	96	82
8. Second glume 5-7-nerved..... <i>Bromus kalmii</i>	96	82

Figure 96.

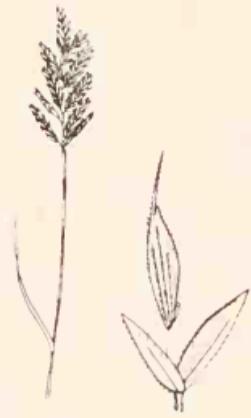
*Bromus hordeaceus.**Bromus porteri.**Bromus kalmii.*

		FIG.	PAGE
9. Awns straight	10	97	66
9. Awns strongly bent near the base.....	<i>Bromus squarrosus</i>	97	82

Figure 97.

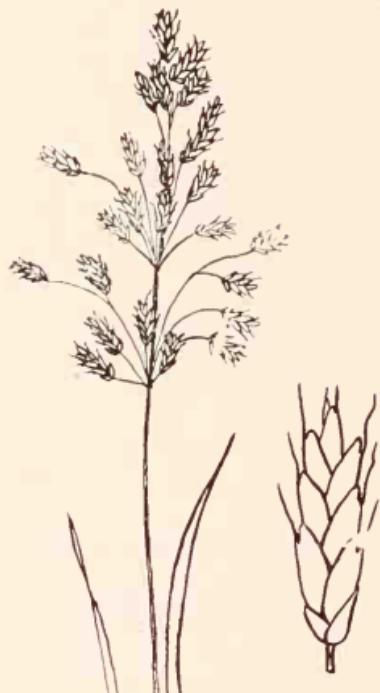


10.

Bromus squarrosus.

		FIG.	PAGE
10. Sheaths smooth	<i>Bromus secalinus</i>	98	82
10. Sheaths hairy	<i>Bromus racemosus</i>	98	82

Figure 98.

*Bromus secalinus.**Bromus racemosus.*

HORDEAE.

1. Spikelets solitary in the notches of the zigzag rachis	2	99	67
1. Spikelets 2-6 in each notch of the zigzag rachis	3	99	68

Figure 99.



2.



3.

	FIG.	PAGE
2. Spikelet with its edge to the rachis. . . . <i>Lolium</i>	100	70
2. Spikelet with its side to the rachis. . . <i>Agropyron</i>	100	71

Figure 100.



Agropyron.



Lolium.

	FIG.	PAGE
3. Spikelet 1-flowered, with two aborted spikelets.....	Hordeum 101	76
3. Spikelet 2-many flowered	4	101

Figure 101.



Hordeum.



4.

4. Glumes minute or none.....	<i>Hystrix patula</i> 102	87
4. Glumes usually equaling the lemma.....	5	102

Figure 102.

*Hystrix patula*.

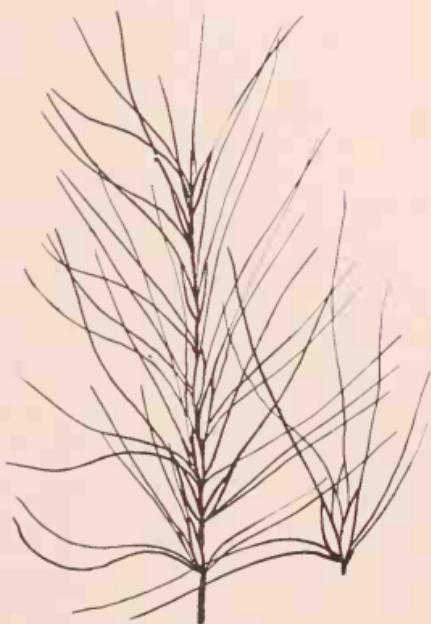
5.

	FIG.	PAGE
5. Rachis continuous	<i>Elymus</i> 103	73
5. Rachis articulated and fragile	<i>Sitanion hystrix</i> 103	92

Figure 103.



Elymus.

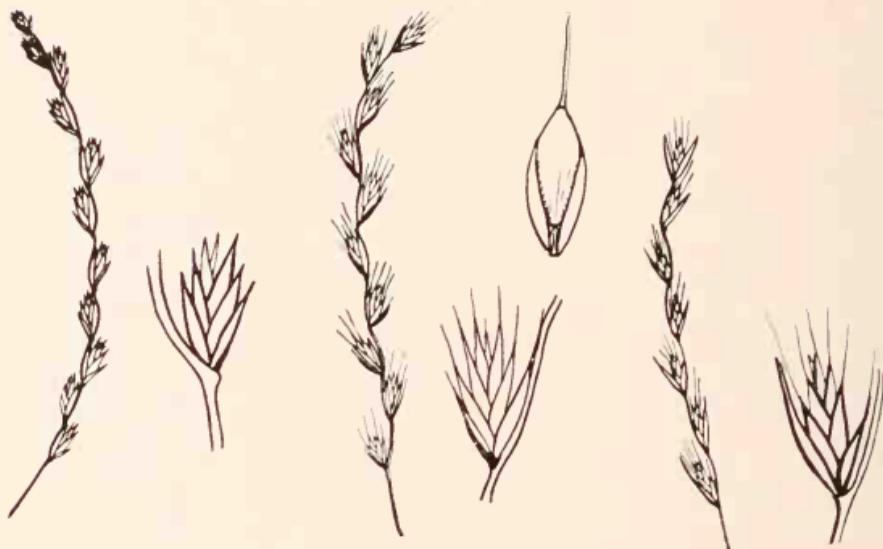


Sitanion hystrix.

LOLIUM.

	FIG.	PAGE
1. Lemma awn-pointed or awnless. <i>Lolium perenne</i>	104	89
1. Lemma long-awned	2	
2. Glume shorter than the lemma.....		
..... <i>Lolium multiflorum</i> 104		89
2. Glume as long as or exceeding the lemma....		
..... <i>Lolium temulentum</i> 104		89

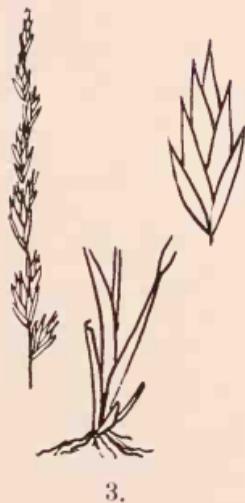
Figure 104.

*Lolium perenne.**Lolium multiflorum.**Lolium temulentum.*

AGROPYRON.

	FIG.	PAGE
1. With rhizome	2	105
1. Without rhizome	3	105
		72

Figure 105.

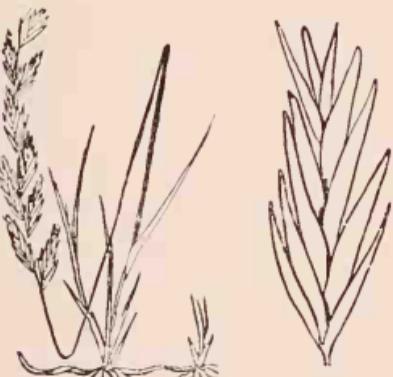


2. Spikelet 3-7-flowered	<i>Agropyron repens</i>	106
2. Spikelet 7-13-flowered	<i>Agropyron smithii</i>	106
		77
		78

Figure 106.



Agropyron repens.



Agropyron smithii.

	FIG.	PAGE
3. Lemma long-awned.....	<i>Agropyron caninum</i>	107
3. Lemma short-awned, or awnless.....	4	
4. Spikes 8-20 cm. long; green or straw colored	<i>Agropyron tenerum</i>	107
4. Spikes 3-10 cm. long; purplish.....	<i>Agropyron biflorum</i>	77

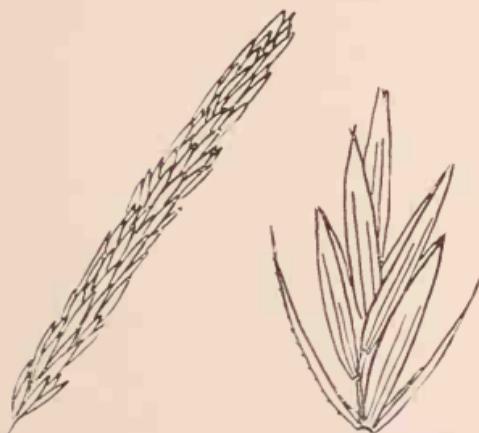
Figure 107.



ELYMUS.

	FIG.	PAGE
1. Lemma awnless or awn-pointed.....		
..... <i>Elymus condensatus</i> 108	108	85
1. Lemma conspicuously awned.....	2	108

Figure 108.

*Elymus condensatus.*

2.

2. Spikelets divergent from the rachilla of the broad spike	3	109
2. Spikelets appressed to the rachilla of the narrow spike	6	109

Figure 109.



3.



6.

	FIG.	PAGE
3. Spike slender	<i>Elymus striatus</i>	110
3. Spike stout	4	110

Figure 110.

*Elymus striatus.*

4.

4. Lemma smooth	<i>Elymus virginicus</i>	111
4. Lemma rough or hairy	5	111

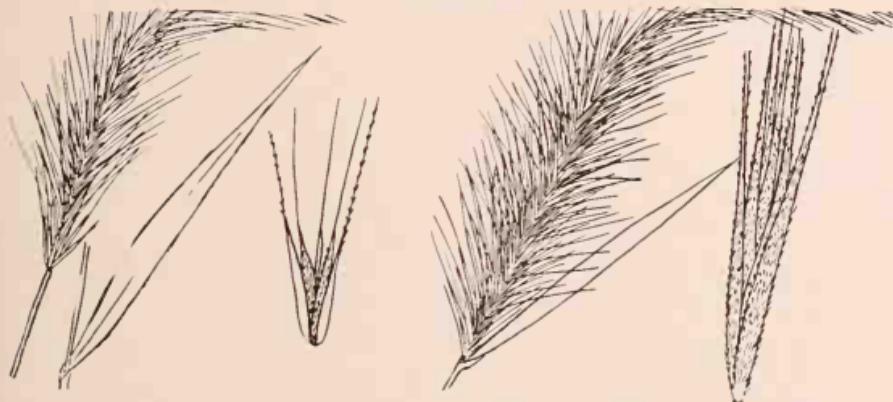
Figure 111.

*Elymus virginicus.*

5.

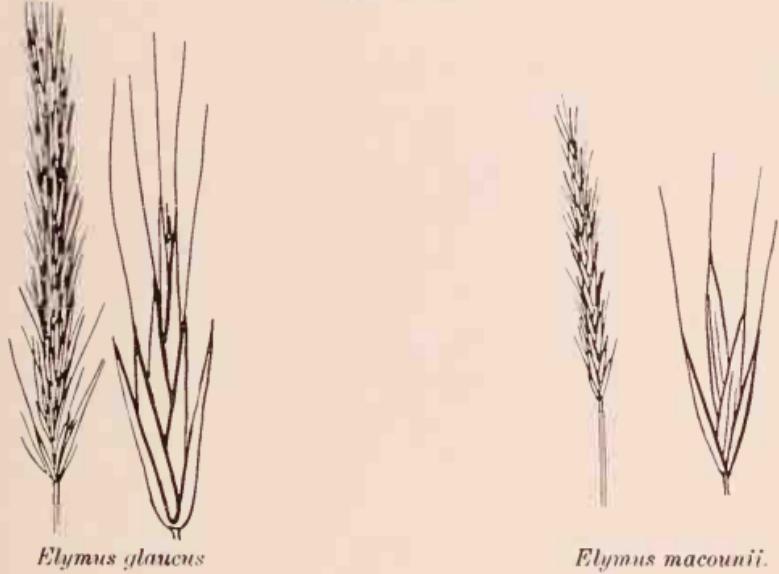
	FIG.	PAGE
5. Spike loosely flowered; long pedicelled.		
..... <i>Elymus canadensis</i> 112		85
5. Spike densely flowered; included at the base.		
..... <i>Elymus robustus</i> 112		86

Figure 112.

*Elymus canadensis.**Elymus robustus.*

6. Spikelet 3-6-flowered.	<i>Elymus glaucus</i> 113	85
6. Spikelet 1-3-flowered.	<i>Elymus macounii</i> 113	85

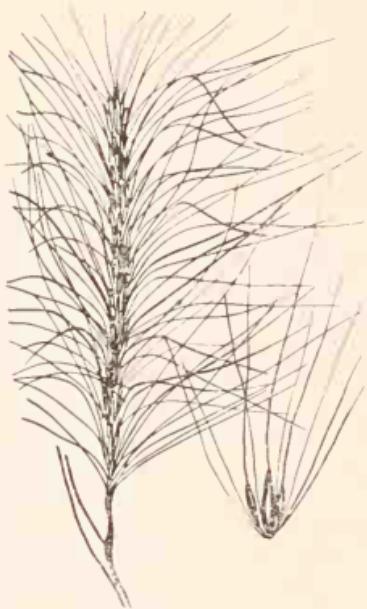
Figure 113.

*Elymus glaucus**Elymus macounii.*

HORDEUM.

	FIG.	PAGE
1. Spikes bushy; with spreading awns.....	<i>Hordeum jubatum</i>	114
1. Spikes narrow; with nearly erect awns.....	<i>Hordeum pusillum</i>	87

Figure 114.

*Hordeum jubatum.**Hordeum pusillum.*

NOTES ON ECONOMIC GRASSES.

No grass can be grown under cultivation on any large scale unless it is possible to secure its seeds in sufficient quantity and at a reasonable price. The failure of many otherwise very desirable species to seed freely under cultivation makes their use quite impossible.

The use of grasses for specific purposes depends upon various other characters, only one of which is here mentioned. Rhizomes of many perennial grasses are continued by the formation of shoots from the lower nodes of the flowering shoots. The method by which these shoots are formed determines whether the grass will be a "bunch" grass or a sod or "tnrf" grass. The buds mentioned develop within the sheath and if they continue their growth enclosed by the sheath they are called intra-vaginal. Such grasses are apt to form bunches or tussocks. On the other hand, if these buds early break thru the sheath, then extra-vaginal shoots result and these spread the grass over a considerable area by means of the resulting stolons. This type of grass will form a more or less compact tnrf or sod. Moreover, bunch grasses would be of little value as sand binders in comparison with grasses of the latter type.

The following notes have been compiled to serve as an introduction to further study and experimentation with our native grasses. The Department of Agricultural Botany desires to receive specimens of our native grasses and information concerning their behavior. Such specimens will furnish us more accurate data regarding the distribution of our various grasses throughout the several counties.

AGROPYRON.

1. *Agropyron biflorum*. Purple Wheat Grass. (Fig. 107.)

A slender perennial of western Nebraska.

2. *Agropyron caninum*. Awned Wheat Grass. (Fig. 107.)

An erect grass sparingly naturalized in cultivated ground and meadows. The bearded nodding heads resemble somewhat heads of wheat. Unlike Conch Grass this species has no rootstocks. It may readily be propagated by the seeds, which are easily gathered.

3. *Agropyron repens*. Conch Grass. (Fig. 106.)

A stout perennial grass which forms a dense sod by means of its extensive system of rhizomes. It is a valuable hay grass, but, like Western Wheat Grass, it soon

"binds itself out" and the sod must again be broken to restore the yield. It should prove to be a valuable sand-binding grass on railroad embankments and other places subject to blow-out. It is ordinarily considered a noxious weed, the eradication of which is very difficult.

4. *Agropyron smithii*. Western Wheat Grass. (Fig. 106.)

In the western part of the State this is one of our most valuable grasses. It is an erect perennial resembling in many respects Couch Grass, but on account of the bluish color of its foliage often receives the name "Bluestem," a name, however, which should be reserved for species of *Andropogon*.

5. *Agropyron tenerum*. Slender Wheat Grass. (Fig. 107.)

This is a perennial bunch grass of the western prairies. The seed can ordinarily be secured on the market, and its cultivation may be expected to increase in the future. It produces a large amount of forage and ripens an abundance of seed.

AGROSTIS.

6. *Agrostis alba*. Redtop. (Fig. 51.)

This is an upright hardy perennial whose rhizomes form a rather dense sod. The existence of many forms of this species has led to much diversity of opinion as to the value of the grass under cultivation. The taller forms may be cut for hay, while the low-growing sorts are unsurpassed lawn grasses. It prefers a rather moist soil and should do best when sown with clovers or other grasses. It prefers a rather moist soil and should do best when sown with clovers or other grasses. In low ground it often drives out the native grasses.

7. *Agrostis exarata*. Northern Redtop. (Fig. 51.)

This is a variable species found in the wet places in the western part of the State. Some of the forms are to be recommended for cultivation on account of their heavy foliage and vigorous growth.

8. *Agrostis hyemalis*. Hair Grass. (Fig. 51.)

A well-known slender grass of the early summer found throughout the State. The panicle is often blown about like a tumbleweed.

9. *Agrostis perennans*. Thin Grass. (Fig. 51.)

This species is much like *Agrostis hyemalis* but flowers much later in the season. Cass County.

ALOPECURUS.

10. *Alopecurus geniculatus*. Water Foxtail. (Fig. 33, 34.)

A low slender rather procumbent perennial grass of eastern Nebraska. In that region in low pastures and meadows it provides excellent grazing. One of the forms of this grass is a good turf grass.

ANDROPOGON.

11. *Andropogon furcatus*. Big Bluestem. (Fig. 18.)

This is a very tall perennial that formerly was very abundant on the prairies thruout the State. In the western counties it still forms a very important part of the native hay and when cut early is relished by stock. Unless the moisture supply is adequate it does not seed freely, and this is a serious defect of any grass when cultivated for hay.

12. *Andropogon halepensis*. Johnson Grass. (Fig. 17.)

This is an introduced grass long grown in the South and to a limited extent in our southern counties. It develops a very extensive system of rootstocks and in the South it is nearly impossible to eradicate it when once established.

13. *Andropogon hallii*. Colorado Sand Grass. (Fig. 18.)

This is a stout erect perennial which makes a luxuriant growth in the Sand Hills where it can be recommended as a sand-binding grass. It must be cut early if to be used for hay and, tho more woody, is perhaps as valuable as the Big Bluestem.

14. *Andropogon scoparius*. Little Bluestem. (Fig. 18.)

This rather slender perennial is a common prairie grass thruout the State. It is often associated with other species of *Andropogon* and with them may constitute a large part of the native prairie hay. The stems are generally reddish in color.

ANTHOXANTHUM.

15. *Anthoxanthum odoratum*. Sweet Vernal Grass (Fig. 32.)

A perennial sweet-scented grass with slender erect tufted stems. The bitter taste of its leaves renders it somewhat unpalatable for stock tho a small amount adds a rather pleasant fragrance to hay. Its earliness gives it some value as a pasture grass.

ARISTIDA.

16. *Aristida basiramea*. Tufted Triple Awn. (Fig. 44.)
 An erect, tufted, much-branched perennial common in the Sand Hill region.

17. *Aristida gracilis*. Slender Beard Grass. (Fig. 45.)
 A slender tufted annual of northern Nebraska.

18. *Aristida longiseta*. Dog Town Grass. (Fig. 44.)
 A slender densely tufted, wiry perennial found in dry soils in western Nebraska.

19. *Aristida oligantha*. Prairie Triple Awn. (Fig. 45.)
 In poor dry soil over most of the State.

20. *Aristida purpurea*. Purple Beard Grass. (Fig. 45.)
 A common perennial prairie grass throughout the State.

21. *Aristida tuberculosa*. Long-awned Poverty Grass. (Fig. 44.)
 A rigid, much-branched perennial in dry sandy soil, Kearney County.

ARRHENATHERUM.

22. *Arrhenatherum elatius*. Tall Oat Grass. (Fig. 56.)
 This is a tall loosely-tufted perennial which makes an early growth, thus rendering it of some value in pastures. It grows rapidly and is very drouth-resistant. It does not form a good sod and must therefore be sown with other species.

AVENA.

23. *Avena fatua*. Wild Oats. (Fig. 56.)
 This is an erect glabrous annual found in waste places. It is generally regarded as a serious weed pest—particularly since its stiff twisted awns are rather troublesome to stock.

BECKMANNIA.

24. *Beckmannia erucaeformis*. Slough Grass. (Fig. 62.)
 A stout, tall, erect, coarse perennial growing in tufts along river banks and irrigation ditches. When young it is readily eaten by stock. It is particularly well adapted for low irrigated alkaline soils. Common in western Nebraska.

BOUTELOUA.

25. *Bouteloua curtipendula*. Tall Grama Grass. (Fig. 61.)
 A tall densely tufted perennial with tough perennial roots. The hay is readily eaten by stock, which, however,

on the range prefer the Blue Grama Grass. Its many basal leaves render it a rather valuable pasture grass in dry regions and it cures readily when cut for hay. Thruout the State.

26. *Bouteloua hirsuta*. Black Grama. (Fig. 61.)

This is one of the common tufted perennial grasses of our western Sand Hills. When abundant it forms excellent pasture, its dense tufts and fine leaves being much relished by stock. Thruout the State, but most abundant westward.

27. *Bouteloua oligostachya*. Blue Grama. (Fig. 61.)

This is the commonest and most valuable species of Grama Grass on the Great Plains. It is a slender, erect, tufted perennial with strong rootstocks and numerous basal leaves. No other grass withstands the tramping of stock as does this, and it is thus unsurpassed for grazing purposes. The leaves are short and crowded at the base of the short stem producing dense cushion-like masses pressed close to the ground. It is often improperly called Buffalo grass. It is very drought-resistant and very common thruout the State.

BRACHYELYTRUM.

28. *Brachyelytrum erectum*. Bearded Short Husk. (Fig. 36.)

A slender perennial with unbranched stems in open wooded regions.

BROMUS.

29. *Bromus brizaeformis*. (Fig. 94.)

A slender, erect, tufted annual with nodding panicles of very large spikelets, introduced from Europe.

30. *Bromus ciliatus*. Swamp Chess. (Fig. 93.)

On good soils in wooded parts or shady pastures, it should make a vigorous early growth. Common thruout the State.

31. *Bromus erectus*. (Fig. 93.)

Introduced from Europe. Valley County.

32. *Bromus hordeaceus*. Soft Chess. (Fig. 96.)

An erect or ascending annual or biennial found in fields and waste places.

33. *Bromus inermis*. Awnless Brome Grass. (Fig. 93.)

This is an erect vigorous, hardy perennial with strong creeping rootstocks enabling it to form a thick and firm sod. It is a native of Europe introduced and widely culti-

tivated in many parts of the State for hay. The strong perennial character of this grass and its great drouth-resisting power are qualities which recommend it for general cultivation particularly in semiarid regions. This drouth-resistance was proved for this grass as much as 30 years ago in Hungary where it is still called Hungarian brome grass. It thrives well on loose, sandy soil but on better soil larger yields may be expected. When well established it is not injured by spring and fall frosts. It should be remembered that this grass is often not easily eradicated, and it is, therefore, not specially adapted for use in a short rotation. In the western part of the State, it is highly prized for its sand-binding ability and for this purpose it is very often employed.

34. *Bromus kalmii*. Wild Chess. (Fig. 96.)

This is a rather stout perennial found in central and northwestern Nebraska.

35. *Bromus porteri*. Wild Chess. (Fig. 96.)

This species is very closely related to *Bromus kalmii*. It is a perennial found only in northwestern Nebraska.

36. *Bromus racemosus*. Smooth Brome Grass. (Fig. 98.)

A rather slender annual introduced from Europe. It produces hay of rather good quality. Lancaster County.

37. *Bromus secalinus*. Chess. (Fig. 98.)

This is a well-known introduced annual weed of grain fields and waste places and now found practically throughout Nebraska. It was introduced in agricultural seed into the various parts of the State. The idea commonly entertained by many farmers that wheat degenerates into Chess is utterly without foundation in fact.

38. *Bromus squarrosus*. (Fig. 97.)

Introduced from Europe and now reported from Box-butte and Howard Counties.

39. *Bromus tectorum*. (Fig. 92.)

A low tufted annual which is fast becoming a common weed in the eastern parts of the State. It was introduced from Europe.

BUCHLOE.

40. *Buchloe dactyloides*. Buffalo Grass. (Fig. 57.)

This, the genuine Buffalo Grass, is claimed to have formerly been much more abundant on the prairies than at the present time. It forms numerous, creeping, branch-

ing stolons, similar to those found in Bermuda grass, which root at the nodes, each joint thus forming a new tuft. Thus a close mat of fine leaves is formed which may cover considerable areas. It is unsurpassed for winter pasturage and is considered one of the best grasses for sheep pastures. Throuout the State, but most abundant in the western counties.

CALAMAGROSTIS.

41. *Calamagrostis canadensis*. Yellowtop. (Fig. 50.)

A stout native prairie grass of the western half of the State. It often occupies rather large areas to the exclusion of other grasses and may then yield considerable hay of fine quality. It grows best in rather low moist meadows and has done well under cultivation.

42. *Calamagrostis inexpansa*. (Fig. 50.)

A rather stout erect grass reported from Buffalo, Custer, and Thomas Counties.

43. *Calamagrostis neglecta*. Pony Grass. (Fig. 50.)

A rather slender, erect native perennial on prairies—more common in the western part of the State.

CALAMOVILFA.

44. *Calamovilfa longifolia*. Long-leaved Reed Grass. (Fig. 40.)

A stout long-leaved grass forming an extensive system of rhizomes. It is unsurpassed as a sand-binder for the semiarid regions tho of little or no forage value. Common in the Sand Hill region.

CATABROSA.

45. *Catabrosa aquatica*. Water Grass. (Fig. 70.)

A rather soft and weak aquatic grass of central and western Nebraska.

CENCHRUS.

46. *Cenchrus tribuloides*. Sand Bur. (Fig. 23.)

A common annual weed thruout the State. If cut before the "burs" are formed it makes good hay.

CINNA.

47. *Cinna arundinacea*. Wood Reed Grass. (Fig. 43.)

A tall native perennial common in woods and wet meadows—particularly in the eastern part of the State.

48. *Cinna latifolia*. (Fig. 43.)

A perennial somewhat smaller than the preceding species.

CYDONON.

49. *Cynodon dactylon*. Bermuda Grass. (Fig. 58.)

A creeping perennial that grows readily in poor, sandy soils where other grasses will not thrive. It is very widely cultivated in the South and should prove useful as a sand-binding grass in many places. It is extensively grown as a lawn grass in the South and is propagated thru the use of pieces of the sod.

DACTYLIS.

50. *Dactylis glomerata*. Orchard Grass. (Fig. 73.)

A valuable perennial introduced grass often found escaped from cultivation. It is a bunch grass and makes a rapid, early growth, producing an excellent quality of hay. Its common name is based upon the ability of the grass to make a good growth in shady situations. To counteract its well-known tendency to form tussocks, often considerably raised above the ground, it should be sown with some other grass, preferably awnless bromé grass or meadow fescue. It cannot be recommended for the drier soils of western Nebraska.

DESCHAMPSIA.

51. *Deschampsia flexuosa*. Wood Hair Grass. (Fig. 56.)

A slender, erect, native perennial of little value except in woodland pastures as it grows well in shaded ground. It yields an inferior coarse forage which, when young, is eaten by stock. It shows a tendency to form tussocks.

DIARRHENA.

52. *Diarrhena diandra*. (Fig. 66.)

In moist shaded places in eastern Nebraska.

DIGITARIA.

53. *Digitaria sanguinalis*. Crab Grass. (Fig. 21.)

This is a well-known introduced annual often found in cultivated fields and constituting, particularly in eastern Nebraska, one of our worst lawn weeds. During the latter part of the season it makes a very rapid growth and may take absolute possession of a lawn. It is less common in the western counties.

DISTICHLIS.

54. *Distichlis spicata*. Salt Grass. (Fig. 73.)

This is an erect wiry grass with an extensive system of

rootstocks which often form such a compact sod as to render it a nuisance in farming lands. It is a good sand-binder, but otherwise has no agricultural value. It thrives in alkali soils even when the ground is heavily crusted with alkali. Thruout the State.

ECHINOCHLOA.

55. *Echinochloa crus-galli*. Barnyard Grass. (Fig. 22.)

This is a rank-growing annual weed well-known in rich, cultivated ground, particularly about dwellings. It is so thoroly dispersed thruout the State as sometimes to appear to be indigenous. The species presents several quite distinct forms, each having its own peculiar qualities. One of these has been cultivated in several places and is valuable for green feed and silage, but is too coarse and succulent to make good hay.

ELEUSINE.

56. *Eleusine indica*. Goose Grass. (Fig. 58.)

A coarse tufted annual generally regarded as a weed, particularly in lawns and about dwellings. Introduced from Europe and not common.

ELYMUS.

57. *Elymus canadensis*. Wild Rye Grass. (Fig. 112.)

A stout, smooth perennial which probably has some agricultural value altho it has not been very thoroly tested. It is very abundant on the prairie, low flats, and along the smaller streams thruout the State. When cut early it should form a good quality of hay, tho the frequent presence of "ergot" might render its use for this purpose dangerous.

58. *Elymus condensatus*. Giant Rye Grass. (Fig. 108.)

A stout tufted perennial grass of central Nebraska common in wet alkali soils and along streams, the banks of which are often protected from erosion by its rootstocks. This grass should also be of service as a sand-binding grass along railroads, etc. When young it makes good hay and when allowed to stand it provides considerable winter forage.

59. *Elymus glaucus*. (Fig. 113.)

In moist soil. Central Nebraska.

60. *Elymus macounii*. Macoun's Lyme Grass. (Fig. 113.)

A perennial grass of northwestern Nebraska.

61. *Elymus robustus*. (Fig. 112.)

A stout leafy perennial in rich moist soil in central and western Nebraska.

62. *Elymus striatus*. Demmett Grass. (Fig. 110.)

A slender tufted perennial of the central and northern counties.

63. *Elymus virginicus*. Lyme Grass. (Fig. 111.)

A stout perennial of the eastern and northern counties.

ERAGROSTIS.

64. *Eragrostis capillaris*. (Fig. 79.)

An erect tufted grass of dry fields in eastern Nebraska.

65. *Eragrostis hypnoides*. Creeping Meadow Grass. (Figs. 80, 82.)

This grass has prostrate much-branched stems. Occurs in low wet places, particularly along streams in eastern Nebraska.

66. *Eragrostis megastachya*. Stink Grass. (Fig. 83.)

A showy much-branched annual which emits, when fresh, a strong unpleasant odor. A common weed throughout the State.

67. *Eragrostis pectinacea*. Comb Grass. (Fig. 81.)

A rather pretty weed common in dry fields except in the extreme western part of the State.

68. *Eragrostis pilosa*. Slender Meadow Grass. (Figs. 80, 82.)

A slender decumbent introduced grass occasional in waste places. Lancaster and Sheridan Counties.

69. *Eragrostis trichodes*. Blow-out Grass. (Fig. 83.)

This is a pretty grass of sandy soils and in blow-outs in central and western Nebraska. It has given good results under cultivation and promises well as a hay grass tho the foliage is rather wiry.

ERIOCORA.

70. *Eriocoma cuspidata*. Indian Millet. (Fig. 38.)

A rather slender native perennial bunch grass which thrives in dry sandy soil, even in typical sage-brush land, and is much esteemed for grazing. Western Nebraska.

FESTUCA.

71. *Festuca altaica*. Rough Fescue Grass. (Fig. 89.)

72. *Festuca elatior*. Meadow Fescue. (Fig. 90.)

This perennial grass is a native of Europe, but has long

been cultivated in various parts of the United States and is now thoroly naturalized. Its drouth-resistance recommends it for use in Nebraska where it can be employed as a pasture grass. Sowing with orchard grass has proved successful. It does best on moist soils rather rich in humus.

73. *Festuca obtusa*. (Fig. 90.)

A rather stont, erect, glabrous perennial in open woods and thickets of the eastern counties.

74. *Festuca octoflora*. Slender Fescue. (Fig. 89.)

An erect annual, in sandy soil thruout the State.

75. *Festuca ovina*. Sheep's Fescue. (Fig. 89.)

An erect, tufted perennial found on prairies thruout the State and apparently indigenous in many places.

GLYCERIA.

76. *Glyceria grandis*. Reed Meadow Grass. (Fig. 76.)

An erect, tall aquatic grass of the Sand Hill region of central and northern Nebraska.

77. *Glyceria nervata*. Fowl Meadow Grass. (Fig. 76.)

An erect aquatic grass widely distributed.

HOLCUS.

78. *Holcus lanatus*. Velvet Grass. (Fig. 55.)

An introduced perennial. It is not liked by stock, but may be of some value on soils where better grasses will not grow. Generally considered a weed.

HORDEUM.

79. *Hordeum jubatum*. Squirreltail Grass. (Fig. 114.)

A striking and rather pretty annual weed found thruout the State.

80. *Hordeum pusillum*. (Fig. 114.)

A slender erect perennial in dry or alkaline soils thruout the State.

HYSTRIX.

81. *Hystrix patula*. Bottle Brush. (Fig. 102.)

A slender tufted perennial of fertile moist soils of eastern Nebraska.

KOELERIA.

82. *Koeleria cristata*. Prairie June Grass. (Fig. 70.)

An erect, perennial bunch grass of the prairies and open meadows. For early forage it has some value and

under irrigation it makes good hay tho the yield is low. Common thruout the State.

LEERSIA.

83. *Leersia oryzoides*. Rice Cut Grass. (Fig. 31.)
A rather stont grass in wet soils thruout the State.

84. *Leersia virginica*. Virginia Cut Grass. (Fig. 31.)
A slender decumbent grass common in wet soils thru the eastern counties, but not found in the extreme western part of the State.

LOLIUM.

85. *Lolium multiflorum*. Italian Rye Grass. (Fig. 104.)
A biennial or perennial introduced plant and one of our well-known hay grasses for rich and rather moist lands, particularly in the eastern counties. It is a rapid grower and forms a good turf. It starts earlier, grows more rapidly, and has lighter green foliage and taller, coarser stems than the Perennial Rye Grass. For temporary meadows it can be recommended but is of too short duration for permanent pastures. The seed is generally rather free of impurities and can ordinarily be secured on the market.

86. *Lolium perenne*. Perennial Rye Grass. (Fig. 104.)
This perennial has been cultivated in England for upward of two centuries. Like the Italian Rye Grass it prefers moist and rich loam and clay soils. In this region it cannot be considered as at all the equal of timothy for hay or other purposes.

87. *Lolium temulentum*. Bearded Darnel. (Fig. 104.)
An erect generally rather stout annual in waste places and cultivated grounds.

MELICA.

88. *Melica nitens*. Melic Grass. (Fig. 71.)
An erect grass found at a very few points in eastern Nebraska.

MUHLENBERGIA.

89. *Muhlenbergia mexicana*. Wood Grass. (Fig. 49.)
A much-branched, spreading or ascending grass found in shaded meadows and along streams in many parts of the State.

90. *Muhlenbergia pungens*. Blow-out Grass. (Fig. 47.)
 A tufted rigid native perennial in dry soils of the Sand Hills and prairies of western Nebraska.

91. *Muhlenbergia racemosa*. Wild Timothy. (Fig. 49.)
 This is an upright, sparingly-branched perennial with rootstocks covered with thick scales. It is an excellent hay grass when grown under suitable conditions. Common in wet soil thruout the State.

92. *Muhlenbergia schreberi*. Nimble Will. (Fig. 49.)
 A prairie grass. Cherry, Holt, Lancaster, and Valley Counties.

93. *Muhlenbergia sylvatica*. (Fig. 49.)
 A perennial in woods and on banks of streams. Harlan County.

94. *Muhlenbergia tenuiflora*. (Fig. 49.)
 An erect perennial in rocky woods. Webster County.

MUNROA.

95. *Munroa squarrosa*. False Buffalo Grass. (Fig. 63.)
 A low much-branched annual not liked by stock. Common in the Sand Hill region and often found in blow-outs.

ORYZOPSIS.

96. *Oryzopsis micrantha*. Mountain Rice. (Fig. 38.)
 A slender erect perennial in woods and along streams in the extreme northern and western counties.

PANICUM.

97. *Panicum barbipulvinatum*. (Fig. 28.)
 An erect grass freely branching at the base. Common in the western counties.

98. *Panicum capillare*. Old Witch Grass. (Fig. 28.)
 This is an annual with coarse branching stems and hairy leaf sheaths. In cultivated ground it often becomes a troublesome weed. For fall feed on stubble it may have some value. Common thruout the State.

99. *Panicum dichotomiflorum*. (Fig. 27.)
 A weedy annual grass of the eastern counties.

100. *Panicum huachucae*. (Fig. 29.)
 In prairies. Buffalo, Cherry, Hall, and Holt Counties.

101. *Panicum leibergii*. (Fig. 30.)
 A slender perennial in dry or moist soil. Dixon and Stanton Counties.

102. *Panicum miliaceum*. European Millet. (Fig. 28.)

This is a branching annual which has long been cultivated in Asia and Europe and to a limited extent in the United States. When cut in flower it furnishes a large amount of excellent green feed for stock.

103. *Panicum praeococcus*. (Fig. 29.)

On dry prairies. Custer and Hall Counties.

104. *Panicum scribnarianum*. (Fig. 30.)

An erect branching perennial thruout the State.

105. *Panicum virgatum*. Switch Grass. (Fig. 27.)

A stout, erect, unbranched perennial found on prairies thruout the State. When cut before ripe it produces a very valuable hay.

106. *Panicum wilcoxianum*. Wilcox's Panic Grass. (Fig. 30.)

Common in the Sand Hill region of central Nebraska.

PASPALUM.

107. *Paspalum stramineum*. Beard Grass. (Fig. 22.)

A perennial frequent in sandy soil thruout the State.

PHALARIS.

108. *Phalaris arundinacea*. Reed Canary Grass. (Fig. 32.)

A stout perennial of wet soil widely distributed thruout the State, particularly in the eastern counties.

109. *Phalaris canariensis*. Canary Grass. (Fig. 32.)

An erect annual grass often found along streets in towns. Boxbutte, Kearney, and Lancaster Counties.

PHLEUM.

110. *Phleum pratense*. Timothy. (Fig. 34.)

This is the best known and most largely cultivated hay grass in the northern States where it has become thoroly naturalized. On dry soils only light yields can be expected. It is often sown with other grasses or one of the clovers.

PHRAGMITES.

111. *Phragmites communis*. (Fig. 64.)

One of the tallest of our native grasses, in ponds and along streams thruout the State. The stems often run along the ground for as much as 40 feet, striking root at each node.

POA.

112. *Poa annua*. Low Spear Grass. (Fig. 85.)

A low spreading, introduced annual weed which has made its appearance in eastern Nebraska.

113. *Poa compressa*. Canada Blue Grass. (Fig. 86.)

This is a slender perennial of bluish-green foliage often confounded with the genuine Kentucky Blue Grass from which it may be distinguished by its flattened, decumbent, wiry stems, shorter leaves and shorter, narrower and smaller panicles. It is adapted to somewhat more sterile soil than Kentucky blue grass, but on the whole it is scarcely to be recommended for Nebraska. Thrives the State but not common.

114. *Poa nemoralis*. Spear Grass. (Fig. 87.)

A tufted, erect, perennial grass of western Nebraska.

115. *Poa pratensis*. Kentucky Blue Grass. (Fig. 87.)

This is a well-known perennial grass native of parts of North America and now much grown as a pasture grass. It is in fact the champion pasture grass of the limestone region of Tennessee and Kentucky. With us it is universally employed as a lawn grass where it makes a firm sod. It is better adapted for use in pastures than as a hay crop. However, it is a shallow-rooted plant, not at all suited to dryish conditions.

POLYPOGON.

116. *Polypogon monspeliensis*. Beard Grass. (Fig. 34.)

An introduced plant in fields and waste places. Kearney County.

PUCCINELLIA.

117. *Puccinellia airoides*. (Fig. 76.)

A tufted perennial in alkali soil. Cheyenne, Dawes, and Sioux Counties.

REDFIELDIA.

118. *Redfieldia flexuosa*. Blow-out Grass. (Fig. 68.)

This is a stout perennial native to the sandy soils of the West. Its deeply penetrating and widely spreading rootstocks render it the sand-binding grass par excellence. It is in fact a typical blow-out grass well worthy of trial where drifting sand becomes troublesome. A common grass throughout the Sand Hill region.

SCHEDONNARDUS.

119. *Schedonnardus paniculatus*. Wild Crab Grass. (Fig. 59.)
A low weedy grass in dry places throughout the State.

SCOLOCHLOA.

120. *Scloochloa festucacea*. Sprangle Top. (Fig. 74.)
A stout, erect perennial in wet ground or shallow water.
Grant County.

SETARIA.

121. *Setaria glauca*. Yellow Foxtail. (Fig. 25.)

An erect annual and, like *Setaria viridis*, often appearing in quantities as a weed in alfalfa fields where it has been introduced in alfalfa seed. A common weed throughout the State, but most abundant eastward.

122. *Setaria verticillata*. Bristly Foxtail. (Fig. 24.)

An introduced annual weed often found near dwellings. Its bristles are barbed downward, and this feature enables its heads to cling to clothing and other objects. In the eastern part of the State but not common.

123. *Setaria viridis*. Green Foxtail. (Fig. 25.)

A common weed of fields and waste places where it flowers somewhat earlier than the yellow foxtail from which it may further be distinguished by its greenish bristles. It is a common annual weed found throughout the State.

SITANION.

124. *Sitanion hystrix*. Wild Rye Grass. (Fig. 103.)

A low tufted perennial species of western Nebraska, resembling somewhat squirreltail grass. Dry soil in western part of the State.

SORGHASTRUM.

125. *Sorghastrum nutans*. (Fig. 17.)

Common on prairies throughout the State and of considerable value for hay. It is a stout perennial forming a large proportion of our western prairie hay. Its long root-leaves provide forage of good quality. During dry weather it does not seed freely. It does best on the richer prairie bottoms.

SPARTINA.

126. *Spartina gracilis*. Little Cord Grass. (Fig. 62.)

A pretty grass of western Nebraska in saline marshes, but of little or no value for forage.

127. *Spartina michauxiana*. Slough Grass. (Fig. 62.)

This grass makes a rather coarse hay and must be cut when young. It is well adapted for sand binding on account of its strong, scaly rootstock. In wet places thruout the State—but most common in the southeastern counties.

SPHENOPHOLIS.

128. *Sphenopholis obtusata*. Early Bunch Grass. (Fig. 77.)

A tufted perennial—often growing in moist soil. It is readily eaten by stock and supplies a considerable amount of forage of good quality. Common on prairies thruout the State.

129. *Sphenopholis pallens*. Eaton's Grass. (Fig. 77.)

On wooded bluffs thruout the State.

SPOROBOLUS.

130. *Sporobolus asper*. (Fig. 52.)

Sandy soil thruout the State.

131. *Sporobolus asperifolius*. Prairie Grass. (Fig. 54.)

A low perennial grass of dry prairies in the western half of the State.

132. *Sporobolus brevifolius*. (Fig. 52.)

An erect, slender, tufted grass in dry soil—thruout the State.

133. *Sporobolus confusus*. Prairie Grass. (Fig. 54.)

An annual found only in western Nebraska.

134. *Sporobolus cryptandrus*. Prairie Grass. (Fig. 54.)

A common perennial grass of dry sandy prairies—thruout the State.

135. *Sporobolus heterolepis*. Wire Grass. (Fig. 54.)

Not common, tho found occasionally in eastern and northern Nebraska.

136. *Sporobolus neglectus*. Small Rush Grass. (Fig. 52.)

In dry soil. Brown County.

137. *Sporobolus raginiflorus*. Southern Poverty Grass. (Fig. 52.)

An annual grass of roadsides and waste places in eastern Nebraska.

STIPA.

138. *Stipa comata*. Needle Grass. (Fig. 46.)

A well-known grass of the High Plains of western Nebraska. It is often very troublesome to sheep and other domestic animals.

139. *Stipa spartea*. Porcupine Grass. (Fig. 46.)

This resembles the preceding species, but is stouter and like it is a great pest to sheep. It is most abundant in the eastern Nebraska prairies.

140. *Stipa viridula*. Feather Bunch Grass. (Fig. 46.)

Occurs throughout the State—particularly in western counties.

TRIPLASIS.

141. *Triplasis purpurea*. Sand Grass. (Fig. 67.)

A low annual grass of the Sand Hill ravines of northwestern Nebraska.

TRIPSACUM.

142. *Tripsacum dactyloides*. Gama Grass. (Fig. 13.)

A stout, coarse, perennial of moist soil in southeastern Nebraska. When young it is much liked by stock.

ZIZANIA.

143. *Zizania aquatica*. Indian Rice. (Fig. 31.)

An annual grass growing in ponds and along streams throughout the State. The nutritious grain is often eaten by birds.

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WATROUS, F. L., GRIFFIN, H. H., and PAYNE, J. E.
1901. *Bromus inermis*. Bul. Colo. Exp. Sta. **61**: 1-10.

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1896. The Renewing of Worn-Out Native Prairie Pastures. Circ. Div. Agrostology U. S. Dept. Agr. **4**: 1-4. Figs. 1-4.
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INDEX.

	FIG.	PAGE
<i>Agropyron biflorum</i>	107	77
<i>Agropyron caninum</i>	107	77
<i>Agropyron repens</i>	106	77
<i>Agropyron smithii</i>	106	78
<i>Agropyron tenerum</i>	107	78
Agrostideae		24
<i>Agrostis alba</i>	51	78
<i>Agrostis exarata</i>	51	78
<i>Agrostis hyemalis</i>	51	78
<i>Agrostis perennans</i>	51	78
<i>Alopecurus geniculatus</i>	33, 34	79
<i>Andropogon furcatus</i>	18	79
<i>Andropogon halepensis</i>	17	79
<i>Andropogon halii</i>	18	79
<i>Andropogon scoparius</i>	18	79
Andropogoneae		14
<i>Anthoxanthum odoratum</i>	32	79
<i>Aristida basiramea</i>	44	80
<i>Aristida gracilis</i>	45	80
<i>Aristida longiseta</i>	44	80
<i>Aristida oligantha</i>	45	80
<i>Aristida purpurea</i>	45	80
<i>Aristida tuberculosa</i>	44	80
<i>Arrhenatherum elatius</i>	56	80
<i>Avena fatua</i>	56	80
Aveneae		39
Awn	16	8
Awned Wheat Grass	107	77
Awnless Brome Grass	93	81
 Barnyard Grass	22	85
Beard Grass	22, 34	90, 91
Beard Grass, Purple	44	80
Beard Grass, Slender	45	80
Bearded Darnel	104	88
Bearded Short Husk	36	81
<i>Beckmannia erucaeformis</i>	62	80

	FIG.	PAGE
Bermuda Grass	58	84
Bibliography		95
Big Bluestem	18	79
Black Grama	61	81
Blade	3	68
Blow-out Grass	47, 68, 83	86, 89, 91
Blue Grama	61	81
Blue Grass, Canada	86	91
Blue Grass, Kentucky	87	91
Bluestem, Big	18	79
Bluestem, Little	18	79
Bottle Brush	102	87
<i>Bouteloua curtipendula</i>	61	80
<i>Bouteloua hirsuta</i>	61	81
<i>Bouteloua oligostachya</i>	61	81
<i>Brachyelytrum erectum</i>	36	81
Bract	7, 8	8
Bristly Foxtail	24	92
Bunch Grass, Early	77	93
Bunch Grass, Feather	46	94
Brome Grass, Awnless	93	81
Brome Grass, Smooth	98	82
<i>Bromus brizaeformis</i>	94	81
<i>Bromus ciliatus</i>	93	81
<i>Bromus erectus</i>	93	81
<i>Bromus hordeaceus</i>	96	81
<i>Bromus inermis</i>	93	81
<i>Bromus kalmii</i>	96	82
<i>Bromus porteri</i>	96	82
<i>Bromus racemosus</i>	98	82
<i>Bromus secalinus</i>	98	82
<i>Bromus squarrosus</i>	97	82
<i>Bromus tectorum</i>	92	82
<i>Buchloe dactyloides</i>	57	82
Buffalo Grass	57	82
Buffalo Grass, False	63	89
<i>Calamagrostis canadensis</i>	50	83
<i>Calamagrostis inexpansa</i>	50	83
<i>Calamagrostis neglecta</i>	50	83
<i>Calamorilfa longifolia</i>	40	83
Canada Blue Grass	86	91
Canary Grass	32	90
Canary Grass, Reed	32	90

	FIG.	PAGE
<i>Caryopsis</i>		9
<i>Catabrosa aquatica</i>	70	83
<i>Cenchrus tribuloides</i>	23	83
Chess	98	82
Chess, Soft	96	81
Chess, Wild	96	82
Chlorideae		41
<i>Cinna arundinacea</i>	43	83
<i>Cinna latifolia</i>	43	83
Colorado Sand Grass	18	79
Comb Grass	81	86
Cord Grass, Little	62	92
Couch Grass	106	77
Crab Grass	21	84
Crab Grass, Wild	59	92
Creeping Meadow Grass	80, 82	86
Cut Grass, Rice	31	88
Cut Grass, Virginia	31	88
<i>Cynodon dactylon</i>	58	84
 <i>Dactylis glomerata</i>	73	84
Darnel, Bearded	104	88
Denett Grass	110	86
<i>Deschampsia flexuosa</i>	56	84
<i>Diarrhena diandra</i>	66	84
<i>Digitaria sanguinalis</i>	21	84
<i>Distichlis spicata</i>	73	84
Dog Town Grass	44	80
 Early Bunch Grass	77	93
Eaton's Grass	77	93
<i>Echinochloa crus-galli</i>	22	85
Economic grasses, notes on		77
<i>Eleusine indica</i>	58	85
<i>Elymus canadensis</i>	112	85
<i>Elymus condensatus</i>	108	85
<i>Elymus glaucus</i>	113	85
<i>Elymus macounii</i>	113	85
<i>Elymus robustus</i>	112	86
<i>Elymus striatus</i>	110	86
<i>Elymus virginicus</i>	111	86
Endosperm	9	10
<i>Eragrostis capillaris</i>	79	86
<i>Eragrostis hypnoides</i>	80, 82	86

	FIG.	PAGE
<i>Eragrostis megastachya</i>	83	86
<i>Eragrostis pectinacea</i>	81	86
<i>Eragrostis pilosa</i>	80, 82	86
<i>Eragrostis trichodes</i>	83	86
<i>Eriocoma cuspidata</i>	38	86
European Millet	28	90
False Buffalo Grass	63	89
Feather Bunch Grass	46	94
Fescue, Meadow	90	86
Fescue, Rough	89	86
Fescue, Sheep's	89	87
Fescue, Slender	89	87
<i>Festuca altaica</i>	89	86
<i>Festuca elatior</i>	90	86
<i>Festuca obtusa</i>	90	87
<i>Festuca octoflora</i>	89	87
<i>Festuca ovina</i>	89	87
Festuceae		44
Flower	6, 7, 8	7
Fowl Meadow Grass	76	87
Foxtail, Bristly	24	92
Foxtail, Green	25	92
Foxtail, Water	33, 34	79
Foxtail, Yellow	25	92
Gama Grass	13	94
Giant Rye Grass	108	85
Glume	8	8
<i>Glyceria grandis</i>	76	87
<i>Glyceria nervata</i>	76	87
Goose Grass	58	85
Gramia, Black	61	81
Gramia, Blue	61	81
Gramia Grass, Tall	61	80
Green Foxtail	25	92
Hair Grass	51	78
Hair Grass, Wood	56	84
<i>Holcus lanatus</i>	55	87
Hordeae		66
<i>Hordeum jubatum</i>	114	87
<i>Hordeum pusillum</i>	114	87
<i>Hystrix patula</i>	102	87

	FIG.	PAGE
Indian Millet	38	86
Indian Rice	31	94
Inflorescence	5	7
Italian Rye Grass	104	88
Johnson Grass	17	79
June Grass, Prairie	70	87
Kentucky Blue Grass	87	91
<i>Koeleria cristata</i>	70	87
Leaf	3, 4	6
Lemma	8	8
<i>Leersia oryzoides</i>	31	88
<i>Leersia virginica</i>	31	88
Ligule	3	7
Little Bluestem	18	79
Little Cord Grass	62	92
Lodicule	7, 8	8
<i>Lolium multiflorum</i>	104	88
<i>Lolium perenne</i>	104	88
<i>Lolium temulentum</i>	104	88
Long-awned Poverty Grass	44	80
Long-leaved Reed Grass	40	83
Low Spear Grass	85	91
Lyme Grass	111	86
Lyme Grass, Macoun's	113	85
Macoun's Lyme Grass	113	85
Maydeae		12
Meadow Fescue	90	86
Meadow Grass, Creeping	80, 82	86
Meadow Grass, Fowl	76	87
Meadow Grass, Reed	76	87
Meadow Grass, Slender	80, 82	86
Melic Grass	71	88
<i>Melica nitens</i>	71	88
Millet, European	28	90
Mountain Rice	38	89
<i>Muhlenbergia mexicana</i>	49	88
<i>Muhlenbergia pungens</i>	47	89
<i>Muhlenbergia racemosa</i>	49	89
<i>Muhlenbergia schreberi</i>	49	89
<i>Muhlenbergia sylvatica</i>	49	89

	FIG.	PAGE
<i>Muhlenbergia tenuiflora</i>	49	89
<i>Munroa squarrosa</i>	63	89
Needle Grass	46	93
Nimble Will	49	89
Node	2	6
Northern Redtop	51	78
Oat Grass, Tall	56	80
Oats, Wild	56	80
Old Witch Grass	28	89
Orchard Grass	73	84
Oryzeae		22
<i>Oryzopsis micrantha</i>	38	89
Palea		8
Panic Grass, Wilcox's	30	90
Paniceae		15
Panicle	5	7
<i>Panicum barbipulvinatum</i>	28	89
<i>Panicum capillare</i>	28	89
<i>Panicum dichotomiflorum</i>	27	89
<i>Panicum huachucae</i>	29	89
<i>Panicum leibergii</i>	30	89
<i>Panicum miliaceum</i>	28	90
<i>Panicum praecocius</i>	29	90
<i>Panicum serbnerianum</i>	30	90
<i>Panicum virgatum</i>	27	90
<i>Panicum wilcoxianum</i>	30	90
<i>Paspalum stramineum</i>	22	90
Perennial Rye Grass	104	88
Phalarideae		23
<i>Phalaris arnudinacea</i>	32	90
<i>Phalaris canariensis</i>	32	90
<i>Phleum pratense</i>	34	90
<i>Phragmites communis</i>	64	90
<i>Poa annua</i>	85	91
<i>Poa compressa</i>	86	91
<i>Poa nemoralis</i>	87	91
<i>Poa pratensis</i>	87	91
<i>Polypogon mouspeliensis</i>	34	91
Pony Grass	50	83
Porcupine Grass	46	94
Poverty Grass, Long-awned	44	80

	FIG.	PAGE
Poverty Grass, Southern	52	93
Prairie Grass	54	93
Prairie June Grass	70	87
Prairie Triple Awn	45	80
<i>Puccinellia airoides</i>	76	91
Purple Beard Grass	45	80
Purple Wheat Grass	107	77
 Raceme	5	7
Rachilla	6	7
Rachis	7	7
<i>Redfieldia flexuosa</i>	68	91
Redtop	51	78
Redtop, Northern	51	78
Reed Canary Grass	32	90
Reed Grass, Long-leaved	40	83
Reed Grass, Wood	43	83
Reed Meadow Grass	76	87
Rhizome	1	6
Rice Cut Grass	31	88
Rough Fescue Grass	89	86
Rush Grass, Small	52	93
Rye Grass, Giant	108	85
Rye Grass, Italian	104	88
Rye Grass, Perennial	104	88
Rye Grass, Wild	103, 112	85, 92
 Salt Grass	73	84
Sand Bur	23	83
Sand Grass	67	94
Sand Grass, Colorado	18	79
<i>Schedonnardus paniculatus</i>	59	92
<i>Scolochloa festucacea</i>	74	92
Senellum	9	10
<i>Setario glauca</i>	25	92
<i>Setaria verticillata</i>	24	92
<i>Setaria viridis</i>	25	92
Sheath	3	6
Sheep's Fescue	89	87
<i>Sitanion hystrix</i>	103	92
Slender Beard Grass	45	80
Slender Fescue	89	87
Slender Meadow Grass	80, 82	86
Slender Wheat Grass	107	78

	FIG.	PAGE
Slough Grass	62	80, 93
Small Rush Grass	52	93
Smooth Brone Grass	98	82
Soft Chess	96	81
<i>Sorghastrum nutans</i>	17	92
Southern Poverty Grass	52	93
<i>Spartina gracilis</i>	62	92
<i>Spartina michauxiana</i>	62	93
Spear Grass	87	91
Spear Grass, Low	85	91
<i>Sphenopholis obtusata</i>	77	93
<i>Sphenopholis pallens</i>	77	93
Spike	5	7
Spikelet	6	7
<i>Sporobolus asper</i>	52	93
<i>Sporobolus asperifolius</i>	54	93
<i>Sporobolus brevifolius</i>	52	93
<i>Sporobolus confusus</i>	54	93
<i>Sporobolus cryptandrus</i>	54	93
<i>Sporobolus heterolepis</i>	54	93
<i>Sporobolus neglectus</i>	52	93
<i>Sporobolus raginiflorus</i>	52	93
Sprangle Top	74	92
Squirreltail Grass	114	87
Stamen	7, 8	8
Stigma	7, 8	8
Stink Grass	83	86
<i>Stipa comata</i>	46	93
<i>Stipa spartea</i>	46	94
<i>Stipa viridula</i>	46	94
Swamp Chess	93	81
Sweet Vernal Grass	32	79
Switch Grass	27	90
Sympodia	1	6
Tall Grama Grass	61	80
Tall Oat Grass	56	80
Thin Grass	51	78
Timothy	34	90
Timothy, Wild	49	89
Triple Awn, Prairie	45	80
<i>Tripsacum dactyloides</i>	13	94
Tufted Triple Awn	44	80

	FIG.
Velvet Grass	55
Vernal Grass, Sweet	32
Virginia Cut Grass	31
Water Foxtail	33, 34
Water Grass	70
Western Wheat Grass	107
Wheat Grass, Awned	107
Wheat Grass, Purple	107
Wheat Grass, Slender	107
Wheat Grass, Western	106
Wilcox's Panic Grass	30
Wild Chess	96
Wild Crab Grass	59
Wild Oats	56
Wild Rye Grass	103, 112
Wild Timothy	49
Wire Grass	54
Witch Grass, Old	28
Wood Grass	49
Wood Hair Grass	56
Wood Reed Grass	43
Yellow Foxtail	25
Yellowtop	50
<i>Zizania aquatica</i>	31

